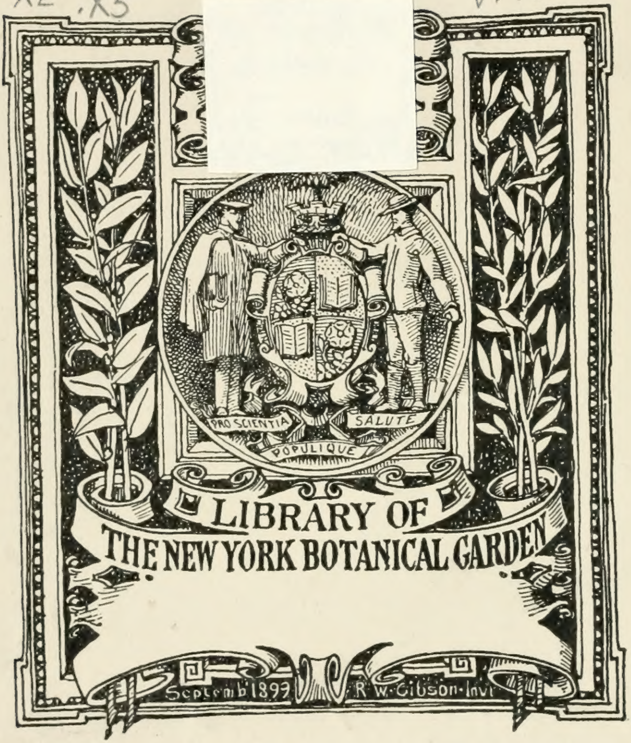
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EXPERIMENT STATION RECORD

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[1] Absent on leave.

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EXPERIMENT STATION RECORD.

VOL. XII. No. 1.

An interesting step looking to the advancement of agriculture in the Russian Empire has recently been taken, on the recommendation of the Ministry of Agriculture and Imperial Estates, in the inauguration of a system of commissioners of agriculture to preside over the agricultural affairs in their respective provinces or governments, and to seek to promote and improve the agricultural conditions in general. Provision has been made for such commissioners in 20 different governments of the Empire, and the appropriation for their maintenance became available with the beginning of the present year. These commissioners will correspond in a general way to our State commissioners of agriculture or secretaries of State boards of agriculture. They will have charge of all public measures relating to agriculture and rural affairs, and will exercise supervision over all local agricultural institutions maintained by the government. They will inquire into the agricultural needs of their respective governments, and will recommend government aid for such local or private enterprises as merit special encouragement.

The commissioners will likewise be charged with the administration of the system of government loans on agricultural improvements and bounties for the encouragement of farm industries. They are expected to take an active part in provincial and municipal agricultural meetings, and to maintain close relations with all societies and conventions of agriculturists.

Connected with the commissioners' offices will be corps of agricultural specialists and instructors, who will be assigned to the work by the Ministry of Agriculture and Imperial Estates. They will go out among the landowners and peasants for the purpose of collecting data regarding the actual conditions of various branches of agriculture, to diffuse general information on agricultural topics, and endeavor to improve the methods and practices in vogue. At the request of farmers they will visit their farms to give expert advice on questions of management, and they will take active measures for the repression of insects, injurious animals, and plant diseases.

The Ministry of Agriculture will cooperate with these various agencies by the issue of manuals and other publications, and the com-

missioners will recommend to the ministry such measures for the promotion of agriculture and the improvement of the agricultural conditions in their respective governments as seem to them desirable.

The inauguration of this system would seem to be a distinct mark of progress. Taken in connection with the recent decrees regarding the establishment of additional agricultural experiment stations and systems of agricultural education, already referred to, it should materially improve and modernize the practice of agriculture in Russia.

The last appropriation act for this Department carried provisions for the inauguration of experiment stations in the islands of Hawaii and Porto Rico. In accordance with this the preliminary steps have been taken to determine the best plan of operation in each case and the subjects which are in most need of immediate attention.

Prof. S. A. Knapp, of Louisiana, who for a considerable number of years has been engaged in subtropical agriculture on an extensive scale, was selected to investigate the agricultural conditions and possibilities of Porto Rico. Professor Knapp went to the island early in June. In general he will study the present agricultural conditions existing in Porto Rico, the lines of experimental investigation which should be undertaken there, especially in the immediate future, and the locations suitable for stations, together with the approximate expense of inaugurating and maintaining the work of the stations. He will also look into the feasibility of undertaking cooperative experiments with the residents of Porto Rico, and the best means of reaching the people through different classes of publications, demonstration experiments, and otherwise.

For the preliminary survey of the conditions in the Hawaiian Islands, Dr. W. C. Stubbs, director of the Louisiana Experiment Stations, has been selected as especially fitted by experience. Dr. Stubbs sailed for Hawaii about the middle of July, and will spend the month of August in the islands. The conditions there with reference to station work are different from those in Porto Rico, as a station for experiments in sugar production has been maintained by private beneficence for a number of years. In connection with his investigation of the location of a station, Dr. Stubbs will consider the feasibility of combining the Federal station with the Hawaiian Experiment Station or the agricultural department of the Kamehameha Manual Training School at Honolulu. Here also the lines in which investigation is most needed, the possibility of greater diversification of the agriculture, the expense of inaugurating and maintaining experiment station work, and the means of disseminating information among the people will be carefully inquired into. This will probably prove a profitable field for investigations on the use and economy of water in irrigation, since according to reports received from authentic sources, in no other place

is so much money expended for pumping water for irrigation. Some of the pumps are said to be raising 30,000,000 gallons of water per day from a depth of 500 feet, using coal that costs $10 a ton. The expense of irrigating in some cases reaches as high as $125 per acre annually.

Preliminary reports will be rendered by Professor Knapp and Dr. Stubbs early in September, in order that the necessary steps may be taken for inaugurating the work as far as the appropriations for this year will allow, and the estimates made for another year. Detailed reports will be presented later in the fall. It is hoped that these reports, by two men so well qualified to judge of the situation, will enable the Department to institute station work in these new possessions on a basis which will secure the greatest direct benefit to their agriculture.

NOTES ON HORSE FEEDING.

E. LAVALARD,

Superintendent of Conferences at the National Agronomic Institute.

For many years the writer has conducted investigations on the feeding of horses for the *Compagnie générale des omnibus de Paris*, with the object of establishing a rational basis for the feeding of horses under different conditions of work. The investigations have covered saddle horses and light draft horses traveling at a rapid gait, horses hauling light loads, and finally heavy draft horses hauling heavy loads at a slow pace. Some years since, the author's earlier work along these lines was included in a treatise on horse feeding.[1]

In these notes no attempt will be made to discuss the principles which regulate the nutrition of horses. This subject has been well treated by Chauveau and his pupil Laulanie; by Duclaux, director of the Pasteur Institute; by A. Gautier, and others in France; and by von Mering, Zuntz, and Wolff, in Germany. All who are interested in investigations on horse feeding are familiar with the experiments of Boussingault; of Baudement, on the horses of the Versailles garrison; of Hoffmeister at the experiment station of Weende, and of E. Wolff, W. Finke, and O. Kellner; and also with the late experiments made in France by Grandeau and Leclerc for the *Compagnie générale des petites voitures*, and those undertaken by the author for the *Compagnie générale des omnibus de Paris*, with the cooperation of A. Müntz,[2] director of the laboratories of the National Agronomic Institute. The special purpose of the present paper is to discuss the practical side of horse feeding, especially the methods employed to maintain, in a satisfactory state of efficiency and health, horses which are required for any definite kind of work—methods which the author has tested repeatedly with army horses and others. No reference can be made to the analytical side of these investigations.[3]

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[1] Le Cheval. Dans ses Rapports avec l'Economie Rurale et les Industries de Transport. 2 vols. Paris: Firmin-Didot et Cie. Some of the author's recent work is summarized in Compt. Rend. Congrès Soc. Aliment. Rat. Betail, 1 (1897), p. 60.

[2] The greater part of the recent investigations on feeding of horses has been noted in the volumes of the Experiment Station Record. The earlier work in which a balance of income and outgo was made is summarized in Office of Experiment Stations Bul. 45.

[3] For details of this phase of the investigation see articles by Müntz, Ann. Inst. Nat. Agron., 1877–78, No. 2, p. 51; 1878–79, No. 3, p. 23; No. 4, p. 75; 1879–80, No. 5, p. 195; 1883–84, No. 9, p. 71.

MEASUREMENT OF THE WORK PERFORMED BY HORSES.

The chief aim in horse-feeding experiments is to learn the amount of nutrients which the animal body, considered as a machine, requires for work. This requires an estimate or measurement of the amount of work performed. Such measurements in the case of draft horses can readily be made with a dynamometer. The measurement of the energy expended by a saddle horse, however, is a different matter. In the opinion of cavalry officers who have studied this question, measuring the distance covered and the rate of speed is practically the only method available. According to Marey, who has devoted considerable attention to the subject, the work accomplished in a given time is proportionate to the square of the velocity. His coefficients were 3.42 for walking or pacing, 16 for trotting, 28.62 for cantering, and 68.39 for a full gallop. That is to say, $4\frac{1}{2}$ times as much work is performed when trotting as when walking, $1\frac{3}{4}$ times as much when cantering as when trotting, and $2\frac{1}{2}$ times as much when on a full gallop as on an ordinary gallop or canter. These are only general statements, and it is impossible as yet to calculate the actual energy expended by saddle horses carrying their riders at different gaits.

It has been suggested that it may be possible to gain an idea of the energy expended by noting the number of pulsations of the flank, which has been found to vary with the gait and with the grade and character of the surface passed over. It is evident that in the case of saddle horses, useful work depends largely upon the speed, since the quantity of work of which the animal is capable diminishes with increased speed. In the same way it has been found with draft horses that the period for which work can be continued diminishes as the speed increases. The conditions under which the work is done are also of importance. External temperature may be mentioned, as well as the conditions of the surface traveled over, the skill of the driver, the methods of harnessing, and the load which must be drawn. Poncelet estimates that a horse carrying a weight of 120 kg. and traveling at a speed of 1.1 meters per second for 10 hours per day performs 4,752,000 kilogrammeters of work. When the weight borne equals 80 kg., the same horse trotting at the rate of 2.2 meters per second for 7 hours per day performs 4,435,000 kilogrammeters of work.

Ellenberger estimates that the Prussian cavalry horse performs 1,500,000 kilogrammeters of useful work daily during the winter months, when less is required of horses than at other seasons. In the spring and summer the preparation for the military maneuvers increases this quantity 200,000 kilogrammeters daily. According to the same author, when a horse travels from 24 to 34 kilometers per day and carries a load of 110 to 125 kg., the energy expended is equivalent to from 300,000 to 500,000 kilogrammeters of work. These

values are naturally still further increased during the military maneuvers. Poncelet's figures are almost the same as Ellenberger's.

In order to determine the distance traveled, the data furnished by Colin are used. A saddle horse walking a kilometer in 10 minutes travels at a speed of 1.66 meters per second. Trotting a kilometer in $4\frac{1}{4}$ minutes, an average speed in the opinion of cavalry officers, he travels 3.92 meters per second. Colin found that the average speed of a trotting horse was 2.72 meters per second. The first value must refer to a full gallop, and the latter value seems to be a fairer estimate. Using this and following Poncelet's method, the amount of work performed by a horse in a day is expressed by the following formula: $P \times V \times T = PVT$ kilogrammeters, in which V = mean velocity in meters, P = mean exertion in kilograms, and T = time. Of course these values necessarily have limits. Thus the limit for T is estimated by Poncelet at 18 hours; that for P, 3 to 5 times that which produces a maximum of effectiveness, and V at 12 to 15 times the velocity best suited to the production of work with the horse under consideration. These values are worth noting, but can not be accepted as final, and there is much disagreement concerning the proper values. It is, however, generally admitted that T is diminished in proportion as $P \times V$ is increased. Race horses furnish a striking illustration of this. Applying the above values to the army horse, which travels more regularly than the others, and assuming that the average rider weighs approximately 80 kg. without a pack and weighs 120 kg. with, the calculated amount of work performed would be as follows:

Work performed daily by an army horse.

	Weight carried.	Velocity per second.	Work per second.	Duration of daily work.		Total of work at different gaits.	Total daily work.
	Kg.	*Meters.*	*Kgm.*	*Hrs.*	*Min.*	*Kgm.*	*Kgm.*
Ordinary work:							
Walking	80	1.66	132.8	2	30	1,195,200	2,361,600
Trotting	80	2.75	216.0	1	30	1,166,400	
Roadwork:							
Walking	120	1.66	199.2	1	30	1,074,600	2,867,400
Trotting	120	2.75	322.0	1	30	1,792,800	
Military maneuvers:							
Walking	90	1.66	149.4	2	00	1,072,800	3,740,400
Trotting	90	2.75	247.5	3	00	2,667,600	

It will be seen that using Poncelet's formula we do not obtain his values, namely, 4,752,000 kilogrammeters for a horse walking 10 hours, carrying a load of 120 kg., and 4,435,000 kilogrammeters for a horse carrying a load of 80 kg. and trotting 7 hours.

The values noted above undoubtedly show something of the labor expended, but are far less exact than results obtained with a dynamometer. With artillery horses and those in the train, the problem becomes much more complicated, since these horses draw a load and

also carry a rider. Further, the traction is not performed under the same conditions as with ordinary vehicles. The artillery horse travels over such varied surfaces that the rate of speed can not be calculated even approximately. According to some of the writer's experiments, the coefficient of speed of gun carriages and caissons is 2 per cent on roads, 6 to 8 per cent on fallow lands, and 12 per cent on wet, plowed fields.

In view of these difficulties, it is evident that the only means of obtaining at all satisfactory results is to estimate the load carried and hauled per horse over the total distance. The writer's observations on this subject were made with 16,000 horses of the *Compagnie générale des omnibus de Paris*, 17,000 army horses, and about 1,000 horses used for hauling heavy wagons. The experiments have extended over a number of years. The horses of the *Compagnie générale des omnibus* were of nearly uniform size and weight. Those in the army differed in size and weight. In all these tests the weight of the horse has been relied upon as showing whether the ration was satisfactory for the work performed.

The 20,000 or 30,000 horses experimented upon were maintained in good condition, and performed the required work without any noticeable loss of weight, and further the horses still possessed great reserve energy. The numerous weighings which have been made in the progress of these investigations have enabled the author to determine quite accurately what should be the weight of a good horse in perfect health under various conditions of work or rest, taking into account, of course, age and size. In the present paper it is necessary to omit details, but the table below shows the average weights of different kinds of horses in our experiments:

Average weight of horses.

	Kilograms.
Heavy draft horses	700–800
Light draft horses	500–600
Fancy horses, reserve cavalry horses, and horses of the line	450–510
Carriage horses and light cavalry horses	380–400
Artillery and train horses	480–495
Mules	430

It is on the basis of such data that the rations have been varied, according as the horses gained or lost weight.

FOOD REQUIREMENTS OF HORSES.

In connection with the experiments a large number of analyses have been made of food, urine, and feces, and the coefficients of digestibility of many feeding stuffs were determined. The object of our experiments has been to determine the quantity of protein, fat, carbohydrates, and mineral matter necessary for maintaining a horse

of any given weight when no work was required except that for motion of forward progression, and also when work was performed. It was also necessary to measure the amount of work as accurately as possible.

It is interesting to note that as shown by the experiments the longer the period of proper feeding the more satisfactory the production of work. This explains why it is better to depend on rations which build up the body and put the animal in good training, rather than on those fed at the time when the work must be performed. In connection with the investigation of army horses attention has frequently been called to the false economy practiced during periods when the horses had little work to do.

As a result of our investigations, we conclude that a horse performing ordinary work requires 115 gm. of digestible protein and 1,100 gm. of digestible carbohydrates per 100 kg. live weight. When severe work is performed, as during military maneuvers, marching, or in time of actual war, the protein should be increased to 135 gm., the carbohydrates remaining the same. In arriving at this deduction it has been necessary to proceed slowly and make many tests, for the figures given by Boussingault, Baudement, and Wolff did not furnish sufficient data for calculating the necessary standard rations. On the other hand, the rations finally adopted do not differ very greatly from those which have been suggested by experience. It is not surprising that the published statement of the results of our latest investigations differ somewhat from those conducted in 1888, since experimental and analytical methods have been greatly improved, and in all the later calculations digestible nutrients only have been considered.

If the weight of the horse and the chemical composition and digestibility of the feeding stuffs are known it is an easy matter to compute standard rations. The following table, showing the maintenance ration for army horses and mules, is an illustration of such calculations:

Maintenance ration for army horses and mules.

	Peace footing.		War footing.	
	Oats.	Hay.	Oats.	Hay.
	Grams.	*Grams.*	*Grams.*	*Grams.*
Cavalry horses, reserve	5,900	4,000	6,670	4,000
Cavalry horses, line	5,200	3,500	6,110	3,500
Light cavalry horses	4,700	3,000	5,335	3,000
Horses of artillery and train	5,600	3,850	6,440	3,850
Mules	4,900	3,400		

The calculation was found even more satisfactory with heavy draft horses, since the weight of individual horses differs less from the average weight than in the case of the smaller animals. For instance, a dray horse weighing about 700 kg. would require, for ordinary work, 805 gm. digestible protein on the basis of 115 gm. per 100 kg. of live

weight, or 945 gm. for more severe work on a basis of 135 gm. per 100 kg. live weight. The same amount of carbohydrates would be required in both cases. At the rate of 1,100 gm. digestible carbohydrates per 100 kg. of live weight the necessary amount would be 7,700 gm. The amounts of protein and carbohydrates called for in these two cases would require 9 to 9.5 kg. of oats and 5 kg. of hay. No account is taken of the straw supplied for bedding, though the little that would be eaten would, of course, supply a small amount of nutrients. The digestible protein and carbohydrates in 9 kg. of oats and 5 kg. of hay is shown in the following table:

Digestible nutrients in a ration of oats and hay.

	Digestible protein.	Digestible carbohydrates.
	Grams.	*Grams.*
Oats (9 kg.)	675	5,780
Hay (5 kg.)	210	2,268
Total	885	8,048

As has been stated, one of the principal objects of our investigation has been to establish the ration of grain and coarse fodder on the basis of the amount of work required. The owners of post horses in early times increased the ration of oats whenever the relays were less frequent, and hence the distance traveled was greater than usual. While such changes were empirical, it may be said that in general all the post horses used on the mail and stage coaches before the opening of railroads were fed rations proportionate to the amount of work required of them. It was found necessary to allow these horses to rest at intervals, not on account of the ration fed, but from the fact that they were usually driven beyond their normal speed. A possible reason for this may have been that they were not as highly bred as draft horses of the present time. During these periods of rest the horses were worked on farms at a slow gait. No scientific estimate had been made of the work expended in hauling a heavy stage or mail coach at a rapid gait.

The difficulties in the way of accurately estimating the work performed by horses constitute the chief reason why we adopted the plan of proportioning the amount of nutrients fed to the weight of the animal. If the weight diminishes it is because the food supplied is not sufficient for the energy expended. It was stated above that the weight of large horses of uniform size was less variable than that of small horses. In 1851 Baudement noted that the largest and heaviest horses apparently derived the greatest benefit from a uniform ration. According to his explanation this was not because they made better use of a uniform ration than smaller horses, but because their losses in

weight were actually less in proportion to their size. The physiological reason for this, Baudement believed, is that large horses, other things being equal, actually change in weight less readily than small horses, since the organs of secretion and the surface area (which serves for the radiation of heat) do not vary regularly in proportion to size, but are relatively larger in animals of small size, and do not perform their functions as economically in small as in large animals. The writer's observations have led to the same conclusions. This theory shows why somewhat larger amounts of protein and carbohydrates are considered necessary per 100 kg. live weight with small horses than with large ones, and also why small animals are often given rations especially rich in protein.

Although the standard rations suggested are based on a very large number of estimates, they should be considered the minimum amounts which will keep horses in condition and prevent premature wearing out. Chardin, an army veterinarian and the author of a recent work on army horses,[1] gives estimates which are smaller than ours. They are in effect as follows: It is probable that the average daily work performed by army horses is about 700,000 kilogrammeters. According to the investigations of A. Sanson, 1 kg. of protein combined, as it should be in a satisfactory ration, with 5 to 6.5 kg. of carbohydrates, would supply 1,600,000 kilogrammeters of energy; hence 700,000 kilogrammeters would require the consumption of 437.5 gm. of protein. Oats contain on an average 12 per cent of protein. Therefore 3,645 gm. of oats would be required in order to furnish the necessary 437.5 gm. of protein. As a general rule, the rations of French army horses contain about 800 gm. in excess of this amount, as is shown by the official statistics published by the French Government in 1887. On the other hand, the quantity of hay supplied is about 2 kg., or one-third less than it should be. It must be remembered that so far only external work has been considered. The internal muscular work must also be provided for. The surplus amount of oats mentioned serves for this but is not quite sufficient, and the deficiency is made up by the straw consumed. This also serves a useful purpose in another way. It increases the bulk of the ration. It is not certain, however, that sufficient straw is consumed.

This summary shows the difficulties of the problem under consideration. It is the writer's opinion that his values are more nearly proportional to the actual requirements than those of Chardin.

Turning to the investigations which have been made on this subject in Germany, we find that Ellenberger's researches led to an increase in the grain ration supplied to the army horse. The author recently had the opportunity of personally becoming familiar with the investiga-

[1] Hygiène du cheval de guerre. Paris: Asselin & Houzeau, 1898.

tions of Zuntz and Lehmann (E. S. R., 7, p. 545). In experiments with the light cavalry horses of the German army (estimated to weigh, on an average, 450 kg.) these investigators arrived at results identical with those obtained in our experiments with horses of the line. The principal object of Zuntz and Lehmann's investigations, which were made with horses at rest and performing muscular work, was the determination of the amount of oxygen consumed and carbon dioxid produced in a unit of time, *i. e.*, the respiratory quotient. In their calculations these authors have assumed that in general cavalry horses perform two-thirds of their work trotting and one-third walking, and that in ordinary weather the ground passed over is fairly even, firm, and springy. They divide the year into three periods: The first of 150 days of work and 31 of rest, the second of 65 days of work and 29 of rest, and the third of 67 days of work and 23 of rest. The first period corresponds to the winter season, during which the horses travel on an average about 15 kilometers per day; the second to a period devoted to drilling, during which they travel about 30 kilometers per day; and the third period to the time of the military maneuvers, when they travel about 60 kilometers per day. The corresponding amounts of work are calculated on the supposition that in the first period the horses each carry a weight of 82 kg.; in the second, of 90 kg.; and in the third, of 110 kg. Zuntz and Lehmann compared the rations supplied in the German army with the work required in the third period, and came to the conclusion that they were quite insufficient. They believe that in order to make good the loss entailed by this work, 1,718 gm. of oats should be added to the daily ration, which at present consists of 5,400 gm., and that it would be profitable to make this addition throughout the entire year and not simply during the time of the maneuvers.

It is interesting to note that these German scientists, using laboratory methods, obtained practically the same results as the author with experiments of a different character, but made upon a very large number of horses.

PREPARATION OF FEED FOR HORSES.

Some of our recent experiments have had to do with the methods of feeding. They cover a number of points. The first and perhaps the most important is the advantage of cleaning the grain. Grandeau showed in his experiments at the laboratory of the *Compagnie générale des voitures* that oats could be satisfactorily freed of foreign grains and impurities by some of the well-known screening devices. He studied the composition of the impurities, and found that some of them were injurious to the health of horses.

The importance of proper cleaning is illustrated by a point in our own experience. A few years ago, after a very severe drought, we

were compelled to feed oats containing tares and leguminous seeds, some of which were those of species of Lathyrus. Symptoms of Lathyrus poisoning were noted in a number of horses. The attacks were frequently severe and sometimes fatal. When the oats were properly cleaned this trouble was entirely obviated. Cleaning also increases the density of the oats by removing mineral matter and dust, which may sometimes induce attacks of intestinal obstruction, colic, etc.

Contrary to the opinion of some experts, the writer believes it is not necessary to grind grain for horses. This is especially true in the case of oats. It does not appear that the advantages gained by grinding are sufficient to cover the cost of the operation. In some of our earlier experiments, where ground grain was fed, it was noticed after a few months that the horses preferred to crush it themselves. Of course this does not refer to old horses. They can be fed ground grain to advantage.

For the past four or five years we have chopped coarse fodders, using a ration of equal parts of hay and straw, and have found this practice the most profitable for several reasons: Straw may thus be made to form an integral part of the ration, and the proportion of hay and straw may be accurately regulated. Furthermore, horses waste much less of such fodder, especially if some material other than straw is used for bedding. Experiments are now in progress under the author's direction with whole and chopped fodders, to study the comparative cost, the most favorable conditions, and the nutritive value of chopped fodder. As yet somewhat contradictory results have been obtained and the experiments must be continued before definite conclusions can be drawn. It may be said with certainty, however, that the feeding of chopped fodder has brought about a considerable saving and permitted greater uniformity than was previously the case in our experiments.

GRAIN FEED FOR HORSES.

In all that has been said above only oats, hay, and straw have been considered, and there are many who maintain that a ration must be made of these articles, especially for army horses. In Europe this prejudice is deep seated. Even if other grains are used for draft horses, oats are regarded as indispensable for saddle horses, carriage horses, etc. Of course in America corn is abundant and ideas and practice concerning its use are different from those which prevail in Europe.

Many analyses, made in connection with our investigations extending over 30 years, have shown that native French oats and foreign oats, with few exceptions, contain about 10 per cent of protein and this value is used in all our calculations. Smaller variations have been observed in the fat and carbohydrate content of oats, and 4.7 per cent

represents about the average for fats and 69 per cent for the carbohydrates (including cellulose).

The writer will endeavor to show that it is possible to substitute other grains for oats and at the same time maintain horses of all kinds in proper condition.

It is frequently said that oats contain a stimulating principle, which has been given the name "avenine," and the energy which race horses manifest has been attributed to this. We do not believe in this theory, and our attempts to discover this body have been fruitless.

The oat kernel is surrounded by a tough hull, and owing to its physical condition is, weight for weight, less nutritious than other grains. The oat hull constitutes from 25 to 30 per cent of the total weight of the grain, and is not very digestible or nutritious. A proof of this is the fact that hulls are almost always recovered whole in the feces. In the digestion experiments published in full in a previous article, the weight of the hulls is noted, and it appears that only about two-thirds of the total weight of the oats is digested.

Formerly other grains were seldom substituted for oats, especially in France, except when oats were very high in price. To-day such substitutions are much more common.

Not only may single grains and other single foods be substituted for oats, but more or less complex mixtures may be used as well. We believe that both from a hygienic and an economic standpoint our experiments have settled this matter, which has provoked so much discussion. An examination of the statistics we have gathered in the last 35 years shows that although a great saving has been effected, it has not been at the expense of the productive power of the horses. The Germans have also begun to substitute different feeding stuffs for oats, and in some cases they have gone so far as to use mixtures of peat and molasses.

Boussingault was perhaps the first to suggest the idea of substituting other materials for oats in the ration of farm horses. With this end in view he devised a table of nutritive equivalents, using hay as a unit. However, since the composition of hay varies within such wide limits, this method is hardly practicable. More recently tables showing the average composition of feeding stuffs have been provided from which the amounts of protein and carbohydrates in any given ration can be calculated. Analyses of the locally grown feeding stuffs are considered preferable. Other materials should be substituted for hay or oats on the basis of their composition, otherwise too much protein may be given, with injurious results, as, for instance, when alfalfa is substituted for ordinary hay, pound for pound.

The principal substitutes for oats are Indian corn or maize, barley, horse beans or other beans, rye, and wheat. The special characters of each deserve some attention.

Indian corn.—Our first experiments in this line were made with Indian corn. They were undertaken with all kinds of horses and gave most satisfactory results. The *Compagnie générale des voitures* and the *Compagnie générale des omnibus* began about 1870 to feed Indian corn, and the results were so satisfactory that since that time the first-named company has almost entirely ceased to feed oats. The latter company has continued to feed both oats and corn, effecting a saving of from 1,000,000 to 1,500,000 francs per year. In view of these facts the opponents of corn have been forced to admit that it is a suitable feed for draft horses. They have insisted, however, that since it does not contain the so-called stimulating principle "avenine" it should not be used for saddle horses and others where speed is required. Examples of the successful use of corn were cited in the author's earlier publications. The horses of the French expedition in Mexico were fed exclusively on corn. Our recent experiments on cavalry and artillery horses have shown that Indian corn may generally replace oats without in any way causing the horses to deteriorate. The horses fed the corn ration were used the same number of hours in the military drill and in the maneuvers, and were ridden at the same gait as those fed exclusively on oats, and it was practically impossible to perceive the least difference between the two classes. The army officers, prejudiced as they naturally were, were forced to admit that all the horses showed the same energy and vigor. A careful record showed that the sickness and mortality were the same with horses on the two rations.

Corn and oats are quite similar in composition. In experiments made at the laboratory of the *Compagnie générale des omnibus* in cooperation with Müntz the author found very high coefficients of digestibility for corn, as shown by the following results: Protein 86.1, fat 93.9, sugar and starch 100, crude fiber 82.8, saccharifiable fiber 86.9, undetermined substances 85.2 per cent. These coefficients show that the nutritive ingredients of corn are much more assimilable than has been generally believed in Europe. As regards physical character, oats contain on an average 70 to 75 per cent of kernel and 25 to 30 per cent of indigestible hull, which resembles straw in composition. The skin or hull of maize amounts to practically nothing. These facts show why horses thrive better and are more apt to maintain their weight on corn than on oats. Our recent experiments have demonstrated that corn can replace oats in the ration of both cavalry and artillery horses, and if substituted weight for weight it increases the nutritive value of the ration. This is the same deduction which was drawn from the experiments, now more than 25 years old, made for the two great cab companies of Paris.

Barley.—Although it is well known that barley can replace oats and indeed is a staple feeding stuff for horses in Italy, Algeria, Spain, and other countries where oats can not be raised profitably, experiments

were undertaken in the laboratory of the *Compagnie générale des omnibus*, and especially in connection with the investigations conducted with army horses, to study the circumstances under which the substitution can best be made. It has been often asserted that barley is not as rich in protein as other cereal grains. Our most recent analyses seem to establish this fact. However, barley is one of the grains whose composition is very variable, being noticeably influenced by the system of cultivation followed.

For 20 years we have been feeding barley to horses. In the experiments with saddle horses and draft horses we use the following values as representing the average composition of barley: Water 12.93, protein 8.83, fat 1.43, carbohydrates 73.66, and ash 3.1 per cent. Certain kinds of barley of good quality showed on analysis from 9.37 to 11.87 per cent of protein. The coefficient of digestibility of the protein of French barley is 80.13, of African 71.07. The coefficient of digestibility of carbohydrates of French barley is 66.24, of African 62.14. The general practice is to substitute barley for oats, weight for weight. In our experiments we followed this custom, but soon observed that the horses fed barley lost weight. It was therefore necessary to increase the quantity of barley in order to supply the same amount of protein and carbohydrates as in the oat ration. When this change was made, the horses regained and preserved the same physical condition as those fed oats. In general it may be said that only barley of good quality should be fed. The barley bran is very tough, and we have noticed that when barley of poor quality is fed the feces contain as much as 4.2 per cent of undigested material, while the feces of horses fed barley of good quality contain scarcely any undigested grain.

In conclusion, barley can replace oats, but a slightly greater amount must be fed. This is especially true when rations are calculated as closely as is the case with army horses.

Horse beans and other beans.—The experiments made many years ago for the Paris cab companies warrant the statement that when beans replace oats only half the quantity should be used. Tests made with army horses have confirmed this conclusion. The chemical composition of beans shows why they are regarded as more nutritious than oats alone. Beans may be advantageously fed to horses required to perform long continued, sudden, or severe labor. The opinion is prevalent in England that in hunting it is always possible to recognize horses fed beans by their great endurance. In accord with the practice of the leading racing stables, we used a large proportion of beans in the ration of young horses which were being trained. The results obtained were most satisfactory.

As shown by our numerous analyses, beans have the following average percentage composition: Water 18.07, protein 24.44, fat 1.06, nitrogen-free extract 48.20, crude fiber 6.05, and ash 2.7. The average

coefficient of digestibility of protein of beans was found to be 89.3 and of the extractives, cellulose, and fat, taken together, 73.3 per cent.

In our experiments with draft horses and saddle horses, we have not replaced more than 1 to 2 kg. of oats by an amount of beans supplying an equivalent amount of digestible protein and carbohydrates. It should be said that when beans replace oats there is usually an excess of protein and a deficiency of carbohydrates. This furnishes a reason for the common practice of adding straw or other coarse fodder containing little protein to such rations.

Rye. The Paris cab companies have always fed some rye, especially when this grain was cheap. We tested it also in experiments with army horses. Rye was substituted for oats, weight for weight, and the amount gradually increased until the horses maintained a constant weight. In tests with draft horses, greater latitude was possible in substituting rye for oats, weight for weight, since the ration is always sufficiently large to cover any discrepancies. The utmost precautions were taken to prevent the introduction of ergotized rye, which, as is well known, may cause serious disturbances.

The average percentage composition of rye is: Water 14.5, protein 9.99, fat 1.29, nitrogen-free extract 70.88, crude fiber 1.38, and ash 1.95; the average coefficients of digestibility are: Protein 73.97, fat 54.05, and nitrogen-free extract and crude fiber together 75 per cent.

Our experiments with rye have furnished less definite results than with other grains. We believe this is due to the fact that the value of rye is more influenced by the variation in composition of the grain and by individual peculiarities of the subject. In former times the feeders of post horses obtained contradictory results with this grain, which they usually attributed to the methods of feeding it. In some countries rye is fed cooked and this method proves entirely satisfactory. It is mixed with oats in the proportion of 1 of rye to 3 of oats, or when cooked, in the proportion of 1 to 3 or 1 to 2 Several years ago we fed rye and oats to the horses of the *Compagnie générale des omnibus* in the proportion of 1 to 4, with entirely satisfactory results, and with an important saving in cost.

Wheat.—Experiments were also made in which wheat was substituted for part of the oats in the daily ration of horses. It is well known that such a mixture is fed by horse breeders when unusual service is required of the stallions. In view of the accidents which have been known to follow feeding wheat, we have taken the utmost precautions in our experiments. It may cause an irritation or itching of the skin so that the horses suffer greatly. This is similar to the effect produced by buckwheat.

A complete survey of the subject of substituting other materials for oats in the ration of horses would necessitate the discussion of such concentrated feeds as bran, barley meal, carob beans, linseed cake, sesame cake, palm cake, cocoa cake, starch cake, maize cake,

cakes from distillery refuse, and other commercial cakes. Our recent tests have added nothing to the deductions drawn from our earlier experiments with these materials. It may be positively stated, however, that the chemical composition and digestibility of any of these feeding stuffs determines the proportion which may be substituted for oats, and that the composition and digestibility of all of them may vary within wide limits. Following the methods that we have used, we believe it is quite possible to devise successful rations for maintenance, transportation, and work.

COARSE FODDERS.

Before closing it seems desirable to add a few words concerning the coarse fodders usually fed with the different grains. In discussing the standard ration it was explained that hay was the principal coarse fodder used and that straw figured only in an incidental manner. The average composition of hay and straw as shown by our analyses of samples grown in many regions of France is as follows:

Average composition of French hay and straw.

	Water.	Protein.	Fat.	Nitrogen-free extract.	Crude fiber.	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Hay	12.8	6.68	1.51	47.76	24.76	6.89
Straw	13.22	2.86	1.39	41.88	34.74	6.20

These coarse fodders may be replaced in the ration of horses by other fodder plants, such as alfalfa, sainfoin, red clover, etc. This statement is borne out by the recent experiments of Müntz and Girard[1] made with the horses of the *Compagnie générale des voitures.*

The statement is often made that horses can not do without straw. This is an error, for we have fed horses hay and oats during very long periods and have never noticed that they suffered any inconvenience or detriment. This is a matter of importance, since it is often inconvenient to obtain straw, and in such cases peat, sawdust, sand, etc., may be profitably used as bedding in place of straw.

Nothing has been said of the use of green fodders. Such feed, however, is more suited to special conditions and is very dependent upon the fertilizer used for the crop, the method of harvesting, and the condition of the animal fed. Green fodder does not contain sufficient nutritive material to make it in any real sense a feeding stuff for horses performing much work. The same may be said of certain plants which have been much advertised from time to time, such as furze, couch grass, etc.

In an earlier publication the feeding value of carrots, parsnips, rutabagas, beets, and potatoes was discussed. The use of these materials has been attempted from time to time with varying success.

[1]Ann. Agron., 24 (1898), p. 5.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

The volumetric determination of potash, R. H. ADIE and T. B. WOOD (*Proc. Chem. Soc. London, 16, pp. 17, 18; abs. in Chem. Centbl., 1900, I, No. 10, p. 572*).—In the method proposed the potash is precipitated by means of cobalt nitrite, the precipitate usually having the formula $K_6Co_2(NO_2)_{12}.3H_2O$. The method is carried out as follows: The potash solution is freed as far as possible from other bases, acidified with acetic acid, and an excess of sodium-cobalt nitrite is added. After 24 hours the precipitate is collected on an asbestus filter, washed with 10 per cent acetic acid, and finally with water. The filter with the precipitate is then boiled in dilute soda solution, filtered, and diluted to 100 cc. Twenty cubic centimeters of this solution is acidified with dilute sulphuric acid and immediately titrated with permanganate solution. It is recommended to add an excess of permanganate and titrate back with potassium iodid and thiosulphate solution.

A new reagent for detecting and estimating nitrites in water, H. ERDMANN (*Ber. Deut. Chem. Gesell., 33 (1900), pp. 210-215; Ztschr. Angew. Chem., 1900, No. 2, p. 33; abs. in Analyst, 25 (1900), Mar., pp. 81, 82; Bul. Soc. Chim. Paris, 3. ser., 24 (1900), No. 9, p. 406*).—The reagent used is amidonaphtholdisulphonic acid (1:8:4-6), prepared by nitrating, reducing, and heating with sodium hydroxid the naphthalene trisulphonic acid recently described by the author.[1] The method of procedure is as follows: Mix 50 cc. of the water with 5 cc. of a hydrochloric-acid solution of sodium sulphanilate (2 gm. per liter), and after 10 minutes add 0.5 gm. of the amidonaphtholdisulphonic acid in the form of its acid alkali-metal salt. In presence of nitrous acid a brilliant Bordeaux-red color appears, which attains its maximum intensity in 1 hour. To determine the amount of nitrites present the color is compared with that produced by solution of sodium nitrite of known strength or with a colored paper scale.

Methods for the detection of "process" or "renovated" butter, W. H. HESS and R. E. DOOLITTLE (*Jour. Amer. Chem. Soc., 22 (1900), No. 3, pp. 150-152*).—The methods employed consist of tests of the curd, which in the case of renovated butter is different from

[1] Ber. Deut. Chem. Gesell., 32 (1899), p. 3186.

that of normal butter. These tests of the curd consist of the appearance of the butter on heating, the comparison of the separated curd freed from fat with the curd from normal butter, and tests for albumin in the filtered butter. The ratio of casein to albumins may also be determined. In the process butter this has been found to be about 8.6 parts of casein to 1 of albumins. This ratio is determined in the curd which has been thoroughly freed from fat. For determining this ratio 50 gm. of butter is dissolved in ether to a clear solution, the ether solution of fat decanted as far as possible, and the remainder filtered through a separatory funnel. The casein remaining on the filter is washed with water and estimated by the Kjeldahl method. The filtrate is made slightly acid with acetic acid, brought to a boil, and the albumins filtered out and estimated by the same method.

"These tests serve to differentiate between genuine butter and process butter as it is now found on the market."

A comparison of reagents for milk proteids with some notes on the Kjeldahl method for nitrogen determination, A. VIVIAN (*Wisconsin Sta. Rpt. 1899, pp. 179-186*).—A comparative study was made of a long list of reagents for separating the nitrogenous compounds of milk and their decomposition products into distinct groups. The following method of analysis was adopted and used in investigations on the action of ferments on the proteids of milk:

In preparing the extracts for analysis cheese was emulsified by rubbing with warm water, acidified with acetic acid, and boiled. Milk was also acidified with acetic acid and boiled. The same quantities of the filtrates in each case were taken for the different reagents. Determinations were made of the total nitrogen and of the total soluble nitrogen (nitrogen not precipitated by acetic acid and heat). Portions of the extracts were treated with zinc sulphate, tannic acid and sodium chlorid, and phosphotungstic acid, and determinations were made of the nitrogen in the filtrates, the nitrogen in the precipitates being calculated by difference. The nitrogen as ammonia was determined by distilling with magnesium oxid.

In designating the groups of proteids obtained by this method of analysis the following nomenclature was adopted: Nitrogen in insoluble portion (casein, globulin, and albumin—difference between total nitrogen and soluble nitrogen), nitrogen in albumoses (difference between nitrogen in filtrate from zinc sulphate and total soluble nitrogen), nitrogen in peptones by tannin (difference between nitrogen in filtrates from tannic acid and sodium chlorid and from phosphotungstic acid), nitrogen in peptones by phosphotungstic acid (difference between nitrogen in filtrates from phosphotungstic acid and from tannic acid and sodium chlorid), nitrogen in amids (difference between nitrogen in filtrate from phosphotungstic acid and in ammonia), and nitrogen in ammonia.

The distribution of nitrogen in a Cheddar cheese 6 months old was found by this method of analysis as follows: Insoluble portion 3.18, albumoses 0.06, peptones by tannin 0.16, peptones by phosphotungstic acid 0.13, amids 0.86, and ammonia 0.09 per cent.

The following notes are given on the Kjeldahl method as applied to milk and cheese:

"(1) In determining the total nitrogen in milk or cheese it is necessary to boil with sulphuric acid a considerable time after the solution is clear, as it will otherwise froth badly when distilling. With 2 gm. of cheese 3 hours' digestion is none too long.

"(2) In digesting the filtrates from milk in the methods described in this article, they must be watched closely, or they will froth badly when the water has nearly boiled off, and the flame must be turned very low for from a quarter to half an hour.

"(3) The filtrate from zinc sulphate bumps during digestion with sulphuric acid until the water has been driven off. About half a gram of zinc dust added as the flasks are placed over the flame will prevent it.

"(4) In the opinion of the writer, the use of potassium permanganate and potassium sulphid is unnecessary in nitrogen determinations in milk and cheese, and their use has for some time been abandoned. . . .

"(5) [The use of potassium sulphate and mercury for digestion as recommended by Atterberg (E. S. R., 10, p. 605) was tested.] The writer made 50 determinations in which 10 gm. of potassium sulphate and 0.7 gm. of mercury were used in one of the duplicate samples, and the plain Kjeldahl, or Gunning, method in the other. In every case the employment of both reagents shortened the time of digestion from 20 minutes to 1½ hours, according to the substance used."

Chemists' guide for the examination of foods, condiments, commercial products, etc., F. ELSNER (*Die Praxis des Chemikers bei Untersuchung von Nahrungsmitteln, Genussmitteln und Gebrauchsgegenständen, etc. Hamburg and Leipsic: Leopold Voss, 1900, figs. 182*).

Phosphotungstic acid as a reagent for potash, E. WÖRNER (*Ber. Deut. Farm. Gesell., 10 (1899), pp. 4–6; abs. in Chem. Centbl., 1900, I, No. 9, p. 517*).—The use of a 10 per cent solution of commercial crystallized phosphotungstic acid is recommended for the detection of small amounts of potash. In neutral or acid solutions of potash salts this reagent produces a white precipitate.

Substitutes for hydrochloric acid in testing carbonates, J. W. RICHARDS and N. S. POWELL (*Jour. Amer. Chem. Soc., 22 (1900), No. 3, pp. 117–121*).—Acid potassium sulphate, oxalic acid, citric acid, and tartaric acid were tried as substitutes for hydrochloric acid in producing effervescence with natural carbonates in the field. Tartaric acid was found to be the best of the reagents tried, and citric acid nearly as good, both giving satisfactory results.

The volumetric determination of magnesia, J. O. HANDY (*Jour. Amer. Chem. Soc., 22 (1900), No. 1, pp. 31–39*).

On the determination of carbon and hydrogen by combustion in oxygen, using copper oxid, C. F. MABERY and W. R. CLYMER (*Jour. Amer. Chem. Soc., 22 (1900), No. 4, pp. 213–218*).

On the determination of ammonia and nitrogen, A. VILLIERS and E. DUMESNIL (*Compt. Rend. Acad. Sci. Paris, 130 (1900), No. 9, pp. 573–576; Bul. Soc. Chim. Paris, 3. ser., 23 (1900), No. 7, pp. 253–256; abs. in Chem. Centbl., 1900, I, No. 13, p. 733*).—The organic nitrogen is converted into ammonia and the ammonia expelled by boiling with alkali as in the Kjeldahl method. Instead of titrating to determine nitrogen, however, the acid solution is evaporated to dryness and the ammonium chlorid weighed.

On the detection of nitrous acid in water by means of amidonaphtholsulphonic acid according to Erdmann, H. MENNICKE (*Ztschr. Angew. Chem., 1900, pp. 235, 236; abs. in Chem. Centbl., 1900, I, No. 13, p. 733*).—Tests are reported which indicate that Erdmann's method (see above) is a delicate and reliable means of detecting and determining nitrites in water. Some precautions to be observed in manipulation are explained.

The value of methods for detecting nitrites in drinking water, L. SPIEGEL (*Ber. Deut. Chem. Gesell., 33 (1900), pp. 639–644; abs. in Chem. Ztg., 24 (1900), No. 32, Repert., p. 113; Jour. Chem. Soc. [London], 78 (1900), No. 450, II, p. 318*).—The author tested Erdmann's method (see above) in comparison with various other methods for the same purpose and found it less sensitive than the potassium iodid starch method or the Lunge-Elosvay reagent. The author considers determinations of nitrites in drinking water as of little value, since the nitrites represent a transition stage and their determination may be misleading as to normal conditions. Their detection, however, may be of a negative value, and for this purpose the author recommends the use of guaiacol or creosote, which, in presence of nitrites in dilute solution, give an orange and a yellow coloration respectively. These reactions are not interfered with by the presence of oxidizing agents, such as nitrates, chlorates, and hydrogen peroxid, or by ferric salts in amounts usually met with inpotable waters.

On a simple method for determining phosphoric acid in connection with metabolism experiments, A. NEUMANN (*Arch. Anat. u. Physiol., Physiol. Abt., 1900, pp. 159–165; abs. in Chem. Centbl., 1900, I, No. 10, p. 571*).

Estimating the water in cereals—practical methods, J. F. HOFFMANN (*Wchnschr. Brau., 16 (1899), pp. 569–574, 585–588, 605*).

The determination of the sugar content of molasses feeding stuffs, A. MENZEL (*Deut. Zuckerind., 25 (1900), No. 14, pp. 552, 553*).

The preparation of a nonsugar from beet juice, A. RUMPLER (*Deut. Zuckerind., 25 (1900), No. 15, pp. 592, 593*).

A comparison of some formaldehyde tests, B. M. PILHASHY (*Jour. Amer. Chem. Soc., 22 (1900), No. 3, pp. 132–135*).—Several tests for small quantities were compared. Phenylhydrazin hydrochlorid seemed to be the best reagent. A solution of 1 gm. of phenylhydrazin hydrochlorid with 1.5 gm. sodium acetate in 10 cc. of water was used. To 1 cc. of the liquid to be tested 2 drops of the reagent and 2 drops of sulphuric acid are added, giving a green coloration if formaldehyde is present. In weak solutions (1:10,000 to 1:250,000) take 3 cc. of the liquid and 4 or 5 drops of the reagent and of sulphuric acid, heating if necessary.

Tests for the strength of solutions of formaldehyde, H. A. HUSTON (*Indiana Sta. Rpt. 1899, pp. 76, 77*).—The formaldehyde content of 5 samples of commercial formalin was determined from the specific gravity and by the ammonia and the potassium cyanid methods. The results are tabulated. Brief notes are given on different methods of analysis. The table in Allen's Commercial Organic Analysis used in calculating the formaldehyde content from the specific gravity was not considered applicable to the samples examined.

On Hubl's iodin method for oil analysis, A. H. GILL and W. O. ADAMS (*Jour. Amer. Chem. Soc., 22 (1900), No. 1, pp. 12–14*).

A new method for the determination of fat in dairy products, LINDET (*Ind. Lait., 25 (1900), No. 23, pp. 177, 178, fig. 1*).—The method depends upon the solubility of casein in a concentrated solution of resorcin. The sample of milk or cheese is treated with a strong solution of resorcin with the addition of a few drops of alkali. This is heated in a water bath until the separation of the fat is completed. The apparatus devised for the purpose consists in part of a graduated cylinder from which the reading for fat is taken. The addition of some coloring matter for clearly differentiating the fat layer is recommended.

Determination of the fat content of milk by the Wollny refractometer, NAUMANN (*Milch Ztg., 29 (1900), Nos. 4, pp. 50–53, figs. 7; 5, pp. 66–68, figs. 4; 6, pp. 84–86, figs. 2*).—A description of the apparatus and necessary reagents and detailed directions for making the test.

Reducing power of taka-diastase, H. A. HUSTON and A. H. BRYAN (*Indiana Sta. Rpt. 1899, p. 77*).—"A sample of taka-diastase . . . was examined by dissolving 50 mg. of it in 50 cc. of water, adding 20 cc. hydrochloric acid, sp. gr. 1.125, and boiling under return condenser for 2 hours. By this method it was found that 50 mg. of taka-diastase reduced to cuprous oxid a quantity of copper solution yielding 17.2 mg. of metallic copper."

A new method of standardizing weights, T. W. RICHARDS (*Jour. Amer. Chem. Soc., 22 (1900), No. 3, pp. 144–149*).

Regulations for the testing of thermometers (*Jour. Amer. Chem. Soc., 22 (1900), No. 3, pp. 121–129*).

BOTANY.

The origin and early development of the flowers of the cherry, plum, apple, and pear, E. S. GOFF (*Wisconsin Sta. Rpt. 1899, pp. 289–303, figs. 23*).—On account of the lack of accurate knowledge as to the formation and early development of the flowers in fruit plants, the author undertook an investigation to ascertain the time of origin and the rate of progress in the flowers of 4 of the most common fruit trees, namely, the cherry, plum, apple, and pear.

The methods of study are described at some length. It appears that the earliest indications of flower in the cherry were in buds taken July 11. In the plum the flower buds appeared as early as July 8. In the apple the first clear evidence of flowers was found in buds taken June 30, and in the pear in buds taken July 21.

The order of development of the various parts of the flower in different fruits seems to be identical. The calyx and receptacle were the first to appear, being developed at about the same time. Next, the stamens and the petals were also formed at nearly the same time, and these were evidently developed as outgrowths from the calyx or from the receptacle. The last to appear was the pistil, and its development was extremely slow. It was noted that the flowers commenced their growth at about the same time that the wood growth ceased. The bearing of this fact upon the production of fruit may be readily understood, since an abundant fruit crop would exhaust the tree to such an extent that the preparation of flowers for the next season would be retarded.

The morphology of the flower bud is described at some length. It was found that an undeveloped bud scale subtends the flower just as the leaf subtends the bud; in other words, the flower occupies the place of a growing branch in the axil of a bud scale. In the apple and pear the terminal flower of the flower bud is most rapidly developed and expands first. The apple-flower cluster, therefore, is a cyme. In

the plum and cherry the proximal flower is developed slightly in advance of the others, and the flower cluster in this case corresponds to the usual definition of a corymb.

Comparative hardiness of flower buds in the cherry, E. S. Goff (*Wisconsin Sta. Rpt. 1899, pp. 283–288, figs. 2*).—A rather protracted cold period occurred in February, 1899, and on account of the low temperature the effect on flower buds of cherry trees was investigated with considerable interest. Early in April a large number of buds of each variety of cherry grown in the orchard were examined and several important facts brought out. It was found that the central flower buds contained a larger percentage of live embryo flowers than those near the ends of the branches, and the percentage of live embryo flowers increased as the number of flowers in the bud diminished. This was true both on the same tree and in different varieties. But little difference was noted between the hardiness of the basal and terminal buds on the fruit spur.

It is stated that windbreaks would doubtless prevent the destruction of many flowers from the injurious effects of prevailing winds in severe weather, and varieties of Morello species of cherry, in which the number of embryo flowers in the flower bud is comparatively small, are more likely to prove hardy than those in which the number is comparatively large.

Yellow coloring matters accompanying chlorophyll and their spectroscopic relations, C. A. Schunck (*Proc. Roy. Soc. [London], 65 (1899), No. 416, pp. 177–185, pl. 1*).—The author reports on studies made of the yellow coloring matters which are extracted by means of alcohol along with the chlorophyll in healthy green leaves. He concludes that in all crude alcoholic extracts from healthy green leaves 2 yellow coloring matters accompany the chlorophyll; one, chrysophyll, which deposits out of the extracts on standing in lustrous red crystals, often in very small quantity; the other obtained by treating the extract with animal charcoal, the charcoal taking up the chlorophyll and leaving the yellow solution, which deposits on spontaneous evaporation an amorphous substance containing much fatty matter, to which the author has restricted the name xanthophyll. Another yellow coloring matter is sometimes found along with xanthophyll which gives no absorption bands, only an obscuration in the ultraviolet region of the spectrum being noticed. There is also evidence of still other coloring matters which have not yet been separated.

The author believes that xanthophyll is the predominating yellow coloring matter accompanying chlorophyll in the healthy green leaf, and that it is identical with the principal yellow coloring matter occurring in autumn leaves. The absorption bands of the different coloring matters are described at some length.

American grasses—III, F. LAMSON-SCRIBNER (*U. S. Dept. Agr., Division of Agrostology. Bul. 20, pp. 197, figs. 137*). This bulletin is in continuation of Bulletins 7 and 17 (E. S. R., 9, p. 327; 11, p. 219) of the Division. It contains descriptions of the tribes and genera of North American grasses, with analytical keys. Each genus is illustrated and reference is made to all other species of the genus illustrated in the bulletins just referred to. A bibliography of all the authorities cited in the 3 bulletins has been added.

Notes on useful plants of Mexico, J. N. ROSE (*U. S. Dept. Agr., Division of Botany, Contributions from the U. S. National Herbarium, vol. 5, No. 4, pp. 209–259, pls. 16*).—The author records his observations relative to the utilization by the people of Mexico of a number of species of plants.

Studies of Mexican and Central American plants—No. 2, J. N. ROSE (*U. S. Dept. Agr., Division of Botany, Contributions from the U. S. National Herbarium, vol. 5, No. 4, pp. 145–200, pls. 8, figs. 30*).—Descriptions of new and notes on little-known species are given, together with a synopsis of the North American species of several groups.

Two new species of plants from the Northwestern United States, L. F. HENDERSON (*U. S. Dept. Agr., Division of Botany, Contributions from the U. S. National Herbarium, vol. 5, No. 4, pp. 201, 202, pl. 1*).—Descriptions are given of *Aster latahensis* and *Angelica roseana*.

Hesperogenia, a new genus of Umbelliferæ from Mount Rainier, J. M. COULTER and J. N. ROSE (*U. S. Dept. Agr., Division of Botany, Contributions from the U. S. National Herbarium, vol. 5, No. 4, p. 203, pl. 1*).—Descriptions are given of a new genus of Umbelliferæ, to which the specific name *stricklandi* is given the one species.

Three new species of Tradescantia in the United States, J. N. ROSE (*U. S. Dept. Agr., Division of Botany, Contributions from the U. S. National Herbarium, vol. 5, No. 4, pp. 204–206*).—*Tradescantia humilis*, *T. gigantea*, and *T. scopulorum* are described.

Treleasea, a new genus of Commelinaceæ, J. N. ROSE (*U. S. Dept. Agr., Division of Botany, Contributions from the U. S. National Herbarium, vol. 5, No. 4, pp. 207, 208*).—This new genus is separated out of some of the confused material grouped under *Tradescantia brevifolia*, and 3 species are described, *Treleasea brevifolia*, *T. leiandra*, and *T. tumida*.

List of trees and shrubs on the grounds of Purdue University (*Indiana Sta. Rpt. 1899, pp. 136–139*).

New species of fungi from various localities with notes on some published species, J. B. ELLIS and B. M. EVERHART (*Bul. Torrey Bot. Club, 27 (1900), No. 2, pp. 49–64*).—Notes and descriptions on a number of species of fungi, some of which may prove of economic importance, though most are saprophytes or upon plants of little importance from an economic standpoint.

The poisonous and edible fungi of Hungary, G. VON ISTVANFFI (*Die ungarischen essbaren und giftigen Pilze. Budapest, 1899, pp. 20 + 361, pls. 42, figs. 150*).

The position of the fungi in the plant kingdom, H. L. BOLLEY (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 25, pp. 857–859*).—The author argues that if nitrifying organisms are capable of subsisting wholly on inorganic materials, in classification algæ should be derived from fungi and not *vice versa* by degeneration.

Studies on the biology of Penicillium glaucum, F. P. GUEGUEN (*Thesis, Lons-le-Saulnier, 1899, pp. 83, pls. 5*).

The mechanism of root curvature, J. B. POLLOCK (*Bot. Gaz., 29 (1900), No. 1, pp. 1–63, fig. 1*).

Observations on seasonal dimorphism among plants, WETTSTEIN (*Bot. Centbl., 81 (1900), No. 1, pp. 15, 16*).

On the evolution of carbon and nitrogen in the living world, P. Mazé (*Evreux: Hérissey, 1899, pp. 111*).

Evaporation from the young wood of apple trees during winter, A. Truelle (*De l'évaporation du jeune bois des pommiers a cidre pendant l'hiver. Alençon: E. Renaut-de Broise, 1899, pp. 24*).

METEOROLOGY—CLIMATOLOGY.

Annual summary of meteorological observations in the United States, 1899 (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 27 (1899), No. 13, pp. IX+577–597, figs. 5, charts 5*).—This number of the Review gives a table of contents, list of corrections, additions, and changes; an index for Volume 27; and a summary of observations on atmospheric pressure, temperature, precipitation, wind movement, cloudiness, and other meteorological phenomena "based essentially upon data received from about 150 regular stations [in the United States], 28 regular Canadian stations, and a number of voluntary stations." It also includes the following special articles: Remarkable aurora at Braidentown, Fla., November, 1899, by H. Ten Broeck; Small seismic changes caused by building operations, by C. F. Marvin; Notes on the climate of Missouri, by A. E. Hackett; Climatology of St. Kitts, by W. H. Alexander (illus.); Rainfall in central and western Nicarauga, by E. Flint; Tables of dew-point observed at Honolulu, by C. J. Lyons; The weather and the live stock industry, by F. H. Brandenburg; and The barograph on shipboard, by J. Page (illus.), and a note by the editor on the meteorological century.

The general climatic conditions of the year 1899 were as follows:

"*Atmospheric pressure.*—In general, the pressure distribution for the year 1899 differs but slightly from that of 1898. Pressure was generally above the normal east of the Mississippi River in both years. It was markedly above the normal over Nova Scotia and the Maritime Provinces of Canada in 1898, and also in 1899, although in a less degree. In the latter year the Atlantic high, as traced by the isobar of 30.05 mean annual pressure, extended several hundred miles farther to the northwestward than was the case in 1898. Pressure on the Pacific coast and Plateau region was slightly lower in 1899 than in 1898.

"On the immediate Gulf coast of Louisiana, Mississippi, and Alabama pressure was from 0.02 to 0.04 in. above normal in both years, while less than 200 miles inland, viz, at Vicksburg, Meridian, and Montgomery pressure was from 0.01 to 0.04 in. below normal. In both years pressure was also below normal from the Texas coast westward to Arizona and southern California. The rainfall of both years was likewise less than the normal amount. In mentioning these facts the writer does not intend to convey the impression that they stand in the relation of cause and effect. The fact that there was an average difference of 0.07 in. in pressure between Vicksburg and New Orleans, 0.04 between Mobile and Montgomery, and the same amount between Atlanta and Jacksonville would seem to suggest rather marked changes in the normal air motions along the Gulf coast.

"In the annual summary for 1898 attention was called to a trough of low pressure which apparently paralleled the foothills of the Rocky Mountains in that year. A similar trough appears on the pressure chart for the current year and the precipitation generally throughout the axis of the trough was above normal as in 1898.

"*Temperature.* Although the year was characterized by some of the coldest weather experienced within the last 20 or 30 years, the average temperature on the whole was above normal.

"During the greater part of January there were no severe cold waves, but, beginning with the first week in February, the most remarkable cold wave, or series of cold waves, in the history of the Weather Bureau traversed the United States from the North Pacific to the South Atlantic coasts, damaging crops and fruits in the Southern States to a very great extent. The lowest temperatures on record since the beginning of observations were recorded at a number of points in the North Pacific coast States during the first 8 days of the month. From the 9th to the 12th of the month the coldest weather on record was reported at a number of points in the Central, Western, and Northwestern States. During the 13th and 14th a cold wave overspread the Southern and Eastern States, attended on the 13th by the lowest temperatures ever recorded at many points in the Southern and Gulf States. March was a cold, wintry month, and the spring was generally backward, with much snow and unseasonable weather east of the Rocky Mountains.

"In Idaho, Montana, and Wyoming, the western portions of the Dakotas, and Nebraska temperature was below normal for 4 consecutive months, viz, during February, March, April, and May, and also, but in a less degree, during the months of June, July, August, October, and December.

"The summer was marked by an absence of periods of continued high temperature. Very nearly normal conditions prevailed in all parts of the country.

"The fall of the year was generally mild and free from sharp and decided temperature changes.

"Interlake navigation began about the first of May and ended about December 17. The weather in the closing months was quite free from severe storms. . . .

"*Precipitation.*—The precipitation of the year just ended was not evenly distributed. There were 7 separate regions, of greater or less extent, in which more than the normal quantity of rain and snow fell, viz: (1) The Pacific coast from central California to British Columbia, including part of the central and all of the northern Plateau; (2) eastern Wyoming and the Black Hills region of South Dakota; (3) eastern Colorado, Kansas, Oklahoma, and the Panhandle of Texas; (4) northern Wisconsin and the Lake Superior region; (5) southeastern Iowa and central Illinois; (6) a narrow strip of country east of the Appalachians, extending from Augusta, Ga., to Washington, D. C.; (7) the western portion of the Peninsula of Florida.

"Precipitation was markedly deficient in the lower Mississippi Valley, the deficits at the 2 regular Weather Bureau stations in Louisiana being 25 and 29 in., respectively. The rainfall of the Gulf States in 1898 was almost normal, and it seemed at the end of that year that the droughty conditions which had prevailed for a number of years were about to come to an end. The year just closed, however, presents the same marked deficiency in precipitation throughout the Gulf States and Texas that has characterized so many years within the last decade. The cause of the deficiency is not at present known.

"*Meteorology of the Great Lakes.*—The season of navigation was remarkably free from severe storms. . . . The most severe storm of the season occurred on December 11 and 12, at a time, however, when a large number of vessels had gone out of commission.

"The rainfall in the Lake Superior basin was above normal. The snowfall of the winter and spring months was rather heavy not only in the Superior basin but also on the northern shore of Lake Huron, particularly in the Georgian Bay region. On the other hand, precipitation was generally below normal in the basins of Lakes Erie and Michigan, and also over those portions of the watersheds of Lakes Huron and Ontario lying within the boundaries of the United States.

"There was less fog reported during the season of 1899 than during the previous season. The most fog was observed over the central portion of Lake Superior.

"A large amount of ice formed on the lakes during the winter of 1898–99, but winter navigation on Lake Michigan was not suspended except during the severe cold in the early part of February. . . .

"*Thunderstorms.*—The greatest number of thunderstorms occurs in the South Atlantic and Gulf States and the Mississippi Valley. The number diminishes toward the northward and westward, although there seems to be a second region of maximum frequency along the eastern foothills of the Rocky Mountains in Colorado, Wyoming, and northern New Mexico. West of the Rockies, except possibly in Idaho, the number diminishes to less than 20 per annum. In California, Oregon, and Washington they rarely occur on the immediate coast, but are not infrequent in the interior valleys and mountains back of the coast range. In Arizona they are most frequent in July and August, the rainy season in the mountainous part of that Territory.

"There seem to have been more thunderstorms in 1899 than in the preceding year, although the difference is not very great. The greatest increase in the number of thunderstorms in 1899, as compared with 1898, occurred in the States of Florida, Michigan, Wisconsin, Minnesota, Iowa, and Nebraska. In a number of States, particularly those bordering on the Gulf of Mexico, there were fewer thunderstorms in 1899 than in 1898."

The climate of San Francisco, Cal., A. G. McAdie and G. H. Willson (*U. S. Dept. Agr., Weather Bureau Bul. 28, pp. 30, charts 4*).—Data relating especially to temperature and rainfall, accumulated at the San Francisco Station during the last 30 years, are reported in detail.

"The mean annual temperature, as determined from the records of the Weather Bureau for 28 years, is 56.2°. May and November have practically the same temperature. The warmest month is September, 60.9°; the coldest January, 50.1°; the other months have mean temperatures as follows: February, 52°; March, 54°; April, 55°; May, 57°; June, 59°; August, 59°; October, 60°; November, 56°; December, 52°.

"The highest temperature ever recorded in San Francisco was 100° on June 29, 1891, and the lowest 29° on January 15, 1888. Abnormally warm and cold periods last, as a rule, about 3 days. The mean of the 3 consecutive warmest days at San Francisco has never exceeded 76.3°. A period of warm weather during the summer months is, as a rule, brought to a close about the evening of the third day with strong west winds, dense fog, and temperatures ranging from 49 to 54°. The mean of the 3 consecutive coldest days was 40.7°. The greatest daily range of temperature was 43°, on June 29, 1891. . . .

"July and August are practically without rain, while December and January together have nearly 10 in. The annual rainfall is 23 in.

"By comparing the seasonal rainfall with the crop yield it would appear that in years when the rain falls generously in March and April the yield is largest, other things being equal. In other words, it is the time distribution of the rain, more than the intensity or total rainfall, which benefits vegetation. . . .

"The summer fogs of San Francisco result from a chilling of the upper warm air, descending to the ocean surface, and particularly over the cold current close to the shore. There is a great difference of temperature between the valley and the ocean, often 50° within as many miles, and this is probably the prime factor in establishing a marked air movement, shown by the strong indraft through the Gate on summer afternoons."

The meteorology of Ben Nevis in clear and in foggy weather, J. Y. Buchanan (*Trans. Roy. Soc. Edinburgh, 39 (1899), pt. 3, No. 31, pp. 48, pls. 8*).—In this paper observations on pressure, temperature,

rainfall, tension of aqueous vapor, wind, cloud, and sunshine at the summit of Ben Nevis during 13 years, January, 1885, to December, 1897, inclusive, have been grouped in periods of clear weather (24 or more hours during which no fog was recorded), and of foggy weather (3 or more consecutive days during which fog was recorded at every hour). The tabular data show that the maximum rainfall during any one day of the 13-year period was 7.29 in.; the maximum for any one hour 0.85 in. There was a large and continuous excess of atmospheric pressure in clear weather over that in foggy weather, the mean yearly excess being 0.456 in. In foggy weather the vapor tension was that of saturation at the temperature of the air, and the variations were slight. In clear weather the variations were considerable. The mean yearly temperature was 3.57° F. higher in clear than in foggy weather, the maximum monthly excess being greatest in June, when it reached 10.11°. In the first 3 months of the year, however, the temperature was higher in foggy weather than in clear weather, the excess being 2.92° F. in February. The range of mean hourly temperature was much greater in clear than in foggy weather in every month. A nocturnal heating during the winter months was observed both in clear and in foggy weather, though it was more pronounced in the clear weather.

The climate of New York, E. T. TURNER (*Bul. Amer. Geogr. Soc., 1900, No. 2*).—It is stated in *Science, n. ser., 11 (1900), No. 285, p. 955*, that this article "is largely a reprint of a report upon the same subject by Mr. Turner, originally published in the Fifth Annual Report of the Meteorological Bureau and Weather Service of the State of New York (Albany, 1894, pp. 347–457). Several new charts have, however, been added, including some typical barograph and thermograph curves, and two thunderstorm charts."

Meteorological observations, J. E. OSTRANDER and A. C. MONAHAN (*Massachusetts Hatch Sta. Met. Buls. 133, 134, 135, pp. 4 each*).—Daily and monthly summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during January, February, and March, 1900, with notes on the general characteristics of the weather of those months.

Meteorological record (*New York State Sta. Rpt. 1898, pp. 569–577*).—This includes a monthly summary of precipitation at Geneva, N. Y., during 17 years, 1882–1898; and daily and monthly records of the direction of the wind during 1898 and of the temperature during 1898 and during 5 years, 1894–1898.

The weather (*Ontario Bureau Ind. Rpt. 1898, pp. 1–4*).—Monthly summaries of observations at different points in Ontario (with averages for the Province) during the growing season (April to September) of 1897 and 1898, with averages for 1892–1898, on temperature, precipitation, sunshine, etc.

SOILS.

The soluble salts of cultivated soils, F. H. KING and J. A. JEFFERY (*Wisconsin Sta. Rpt. 1899, pp. 219–243, figs. 3*).—In order to study the influence of tillage on the soluble salt content of soils determinations were made of soil moisture and soluble salts in 1 ft.

sections to a depth of 4 ft. on plats of medium clay loam soil having clay subsoil changing to sand at a depth of 4 ft. The soil had been in pasture during 1896 and 1897 and bore a crop of rape in 1898, no fertilizers or manure having been used during this interval. The soil was plowed, rolled, and harrowed on May 23 and was cultivated weekly thereafter until September 15. It was kept fallow and free from weeds.

The methods used in making the determinations are described. For the soluble salts Whitney's electrical apparatus was employed (E. S. R., 9, p. 535). In every case, however, "the amount of dry soil and of moisture in the cell was determined by weighing the cell full before each determination, and then, after measuring the resistance, emptying the contents into the trays, drying the soil, and from the percentage of water calculating the amount of water and of dry soil which occupied the cell when each resistance was measured."

The formula used with the electrolytic soil in these observations was

$$A = 6.06 \frac{W^2}{R\ S}$$

where A is the per cent of soluble salts in the dry soil expressed as sodium chlorid, W the amount of water in the cell, R is the observed resistance at 60° F., S is the amount of dry soil in the cell, and 6.06 is a consta t whose logarithm is 0.782501.

Observations were made at 4 different dates to determine the changes in the soluble salts in the soil with the following results:

The mean change in soluble salts computed as sodium chlorid in fallow ground between May 24 and September 15.

	1st foot.	2d foot.	3d foot.	4th foot.
	Lbs. per acre.	*Lbs. per acre.*	*Lbs. per acre.*	*Lbs. per acre.*
Amount September 15	447.5	347.1	200.1	78.8
Amount May 24	211.9	240.2	164.7	59.6
Gain	235.6	106.9	35.4	19.2

"The mean gain of soluble salts, and presumably of plant food also, has taken place most rapidly in the surface foot, the increase being more than double that in the second foot, nearly 7 times that in the third, and 12 times that in the fourth foot.

"The total mean gain in soluble salts per acre in the upper 4 ft., as indicated by the method, was 397.1 lbs., and the total amount at the end of the season in the root zone was 1,073.5 lbs. per acre."

Observations on the influence of different depths and frequencies of tillage on soluble salts of the soil indicate "that the largest increase in the amount of soluble salts occurred in the surface foot of the fallow plat not cultivated, the final gain between May 24 and September 15 being 533 lbs. per acre, which is 2.6 times the mean gain which occurred in the surface foot of the cultivated soil." The surface foot of plats cultivated once in 2 weeks gained more than that of plats

cultivated once each week. Apparently the methods employed were not sufficiently delicate to show with certainty whether either the frequency or depth of cultivation made any marked difference in the amount of available plant food.

"The mean change in the soluble salt content in the cultivated fallow plats, as indicated by the Whitney method, between May 24 and September 15, was 361.1 lbs. gain, while the increase on the fallow plat not cultivated was 692.2 lbs. per acre. The mean gain in nitric acid (HNO_3) was 330.56 lbs. per acre on the cultivated plats and 371.39 on the ground not cultivated up to August 22."

Similar observations made May 12 and 13 and August 7 on plats on which crops were growing showed that the soluble salts remained nearly constant in the upper 4 ft. of soil, there being a tendency to decrease on the whole rather than to increase. The average decrease observed was 174.2 lbs. per acre, while on the fallow plats the mean gain during the period of observations was, as stated above, 397.1 lbs.

The value of determinations of soluble salts as an index of evaporation from the soil is discussed at some length.

The electrical resistance by Whitney's method, computed as sodium chlorid, the amount of nominal alkalis, partly and possibly largely sodium carbonate, as indicated by Hilgard's method for detecting black alkali, and the amount of nitric acid were determined August 14 in plats of productive and unproductive humus soils planted to potatoes and treated with sodium and potassium carbonates and wood ashes.

"The method of detecting the nominal alkalis in the soil which has been used consisted in weighing into a small muslin sack 50 gm. of the fresh soil and washing this during 2 minutes with 255 cc. of distilled water poured into the sack in a mortar. By holding the sack closed and on its side and working it with the pestle, turning it from time to time, the soluble salts are quickly taken up by the water. The water is then wrung from the sack and the solution poured into a mug to settle. When clear 25 cc. of the filtered solution is evaporated to dryness and then redissolved and titrated against deci-normal hydrochloric acid. The balance of the soil sample is dried to determine the water content and the percentage obtained used in calculating the alkalinity of the soil. . .

"In [determining nitric acid] a weighed fresh sample [of soil], usually 50 gm., was placed in a small muslin sack in a mortar. Into the sack was poured 250 cc. of distilled water. Holding the sack closed in one hand and the pestle in the other the soil was worked by pestling and turning during 2 minutes, when the sack was removed and drained by wringing and squeezing.

"The turbid solution was transferred to mugs and allowed to stand for from 6 to 12 hours to settle. It was found, however, that long standing was not permissible, especially with humus soils, on account of a tendency to denitrification.

"Corrections were made, in the calculations, for the moisture in the fresh sample used by determining the water content in the balance of the sample. This plan was followed to avoid the danger of increasing the nitrogen content by drying and to avoid changing the solubility of the soil by heating, our object being to get the total soluble salts by the Whitney method and the amount of nitric acid by the phenyl sulphate method of Leffmann and Beam."

The largest amount of nominal alkalis was found in the surface 6 in. of the soil treated with sodium carbonate. In general the amount of

soluble salts was higher in the poorer soil than in the better soil, but the difference was not so great as to make it probable that the unproductiveness was due purely to overconcentration of salts. The sum of the alkalis and nitric acid found by chemical methods usually exceeded the total soluble salts indicated by the electrical method.

Similar observations on a humus soil near Hanover Junction showed that plats of this soil planted to onions and treated with land plaster contained 1,043.3 lbs. of alkali per million of dry soil, while untreated plats contained 1,026.44 lbs.

"Samples taken from a wild marsh, where the wild iris grows, showed 682.03 lbs. per million, but where the grass was much shorter and where from previous experience the largest amount of alkalis would be expected if poor crops were due to its presence, the analysis showed a little less, or 639.6 lbs. per million of dry soil."

Determinations of the amount of nitric acid in fallow plats May 24 and August 22 show that the average amount of nitric acid in the surface 4 ft. of soil at the first date was 111.42 lbs. per acre. At the latter date the nitric acid had increased to 430.11 lbs. One series of these plats was cultivated every week, the other once in 2 weeks, but it does not appear that the cultivation had any notable influence on nitrification.

The total gains per acre in nitric acid under the different treatments were as follows:

Gains of nitric acid in soils from May 24 to August 22.

	Pounds.
Cultivated 2 in. deep once per week	315.49
Cultivated 2 in. deep once in 2 weeks	307.44
Cultivated 3 in. deep once per week	321.80
Cultivated 3 in. deep once in 2 weeks	377.52
Not cultivated	371.39

"It is clear in regard to the fallow plats under consideration that if the porosity of the soil on the plat not cultivated was such as to give the nitrifying germs all of the air they could use to advantage, then no amount of cultivation would have increased the rate of niter forming. Indeed, it might be true that frequent shallow cultivation in a wet season, especially on a heavy soil, might so much reduce the amount of air which could enter the unstirred soil below the mulch as to act as a positive check, the excess of moisture retained acting to exclude the air and thus retard nitrification or even bring about the reverse process. Then, too, with the soil moisture held to a high point smaller amounts of rain would be able to produce leaching and in this way cause a greater loss of the nitrates formed than would be the case in a less nearly saturated soil. It is not impossible that these conditions may have operated to lessen the nitrate content in the cultivated fallow plats this season."

In the experiments on the influence of early tillage in conserving moisture, reported elsewhere (E. S. R., 11, p. 520), the nitric acid was determined April 30, 18 days after the soil had been plowed. The results show that the plowing sensibly increased the nitrogen in that time. Determinations of nitrates were again attempted on May 16. While the results were unsatisfactory, they indicated that the amount of nitric acid had been greatly reduced in that time, due to rains, the loss being greatest on the soil in the most open condition.

Nitric acid and total soluble salts computed as sodium chlorid were determined in soil mulch and unstirred soil immediately below the mulch on September 22. The results indicate some difference due to the different depths of cultivation (2 and 3 in.), the nitric acid being higher in the mulches formed by cultivating 2 in. deep than in those formed by cultivating 3 in. deep. There appeared, however, to be no such evident relation between cultivation once a week and cultivation once in 2 weeks.

"The loose mulch developed in the cultivation of the several plats was measured by collecting, weighing, sampling, and determining the water content of the samples, and the results showed that about 42 per cent more loose soil was developed on the 3 in. cultivation than on the cultivation 2 in. deep. The amount of nitric acid shown to be in this mulch was a little more than 200 lbs. per acre."

Determinations of nitric acid made April 15 in irrigated and unirrigated soil to a depth of 3 ft. showed, with one exception, "that the ground which had been irrigated and which produced the largest amount of dry matter showed a larger percentage of nitric nitrogen in the soil."

"It should be said in regard to irrigation that only so much water has been applied as it was thought the crop could use to advantage, and no water had been applied to the irrigated ground since the preceding August; further, the plat has been in corn continuously without fertilizers, since 1894."

The character and treatment of swamp or humus soil, F. H. KING and J. A. JEFFERY (*Wisconsin Sta. Bul. 80, pp. 39, figs. 14*).—The extent and character of swamp or humus soils in Wisconsin are described, and experiments on their management, in continuation of similar work in previous years (E. S. R., 10, p. 728), are reported. Accounts are given of plat and of pot experiments on soil of productive and unproductive areas of a reclaimed marsh with coarse, rotted, and liquid manure; cut and ground straw, ground oats, corn, and rye (with and without addition of carbonate of potash); green manure (oats); gypsum, sand, and clay; magnesium carbonate and sulphate; wood ashes; muriate, sulphate, nitrate, and carbonate of potash; and nitrate of soda. The amount of soluble salts present (nitrates and alkalis) and the effects of leaching, drainage, and adding drainage water from humus soils were also studied. The crop grown was corn.

Notwithstanding the presence of large amounts of nitrates in the soil on May 4, barnyard manure produced a marked increase in the crop, thus indicating that its beneficial effect was not due to increased nitrification.

Applications of sand and clay produced no benefit. Land plaster reduced the amount of alkali present (see p. 31) but did not increase the yield.

In the pot experiments with magnesium salts the carbonate was used in saturated solution at the rate of 541.1 lbs. per acre, the sulphate at

rates of 3,082 and 3,727 lbs., corn being the crop grown. The carbonate decreased the yield on both the poorer and the better soil; the sulphate reduced the yield on the better soil. These experiments were repeated on the same pots with increased applications of the magnesium salts. Similar but more decided results were obtained. Both salts reduced the yield, but the action of the carbonate was more marked than that of the sulphate.

The use of water from the tile drains under humus soil for watering corn grown in pots was not attended with any injurious effect as compared with rain water.

Leaching the soil very materially decreased the yield. Magnesium carbonate was very injurious on leached soils, while the sulphate appeared to be beneficial. There was no indication that the reduced yield was due to the loss of nitrogen by leaching, which was quite large. The plowing under of green oats increased the yield on the poor soil but decreased it on the good soil.

Other general conclusions from this work are thus summarized in the bulletin:

"(1) There are in Wisconsin alone in the neighborhood of 4,000 square miles of humus soils, most of which may readily be drained and put in condition for tillage.

"(2) So far as the elements of plant food are concerned they contain a higher percentage than most of the best upland soils.

"(3) The soil when drained is easy to work and maintains an excellent tilth.

"(4) But when reclaimed they are often found relatively unproductive, especially after 2 or 3 years.

"(5) Their productiveness frequently varies to a marked degree in different seasons and without an evident cause for it.

"(6) Coarse farmyard manure, in almost all cases, greatly improves even the best of these lands, enabling them to give large yields.

"(7) Liquid farmyard manure has not been found to have an appreciable influence on the yield.

"(8) Potassium carbonate, sulphate and nitrate and wood ashes have been found to greatly improve these soils for corn. Kainit improves the yield, but to a less degree. [The beneficial effect of the potash salt is apparently exerted near the surface of the soil.]

"(9) Potassium chlorid in one-half the quantity of other salts killed the corn.

"(10) Land plaster, lime, marl, phosphates, bone meal, and Thomas slag have been tried with little benefit.

"(11) Coarse litter, like straw, plowed in is often very helpful.

"(12) A good dressing of manure may materially increase the yield for 4 consecutive years.

"(13) Heavy crops of oat hay can often be grown upon the lands, but the plants are liable to lodge and not fill well if left to mature.

"(14) It is difficult to get a good stand of clover, and winterkilling is very common.

"(15) Timothy and redtop appear to do best among the grasses, but it is often very difficult to get a stand of these if the field has been cultivated several years.

"(16) Almost any crop may be grown upon these soils, if they are manured, and very heavy crops of corn.

"(17) As pastures these lands only give a moderate amount of feed.

"(18) When undrained and kept in the native wild grass, and cut continuously, these lands in some known cases greatly decrease in productiveness, so much so as to hardly pay for cutting.

"(19) In sowing to grain and seeding after corn, which has been kept clean, it will generally be best not to plow, on account of the naturally loose character of the soil. If plowing must be done and the ground is dry enough to do so, it will be best to roll to increase the firmness.

"(20) When clover has winterkilled, leaving the timothy standing, the ground may be seeded to clover very early in the spring by sowing on the surface and harrowing lightly."

Percolation and evaporation from long columns of soil, F. H. KING (*Wisconsin Sta. Rpt. 1899, pp. 214–218*).—In continuation of previous studies (E. S. R., 10, p. 727), the author made observations (1) on the rate of percolation from saturated sandy loam and clay loam soil in brass cylinders 7 ft. long and 3 in. in diameter, and (2) on loss of water by evaporation from similar soils, mulched and not mulched, in galvanized-iron cylinders 10 ft. long, having a cross section of 0.04611 sq. ft.

In the first case the cylinder was made in sections 6 in. long, which could be screwed together, forming water-tight joints. The top of the cylinder was provided with a closely fitting screw cap and the bottom with devices for collecting, maintaining at a uniform level, and removing the percolating water, with the minimum of evaporation.

"The apparatus was filled with soil containing a good working amount of moisture, and was introduced in small, uniform quantities at a time, tamping each quantity added with the same number of strokes. When filled, the soil was completely saturated with water by filling from the bottom under pressure until the water overflowed at the top.

"The rate of percolation and the amount of it was obtained by weighing at 7 a. m. each morning after the first rapid discharge had taken place, and the table below gives the distribution of moisture by 6-in. sections, as found 60 days after percolation was started."

Distribution of moisture in soil at different distances above standing water after 60 days of percolation without evaporation.

Above standing water.	Sandy loam.	Clay loam.
	Per cent.	*Per cent.*
84 in. to 78 in	16.16	31.16
78 in. to 72 in	16.08	30.70
72 in. to 66 in	16.55	31.05
66 in. to 60 in	16.97	31.11
60 in. to 54 in	17.59	31.21
54 in. to 48 in	17.99	31.94
48 in. to 42 in	18.70	31.99
42 in. to 36 in	19.44	32.18
36 in. to 30 in	20.90	32.45
30 in. to 24 in	21.71	33.31
24 in. to 18 in	21.46	34.40
18 in. to 12 in	22.17	35.54
12 in. to 6 in	22.68	35.97
6 in. to 0 in	27.69	37.16

There were several days during the course of the experiment in which there was no percolation. These were usually days of lower temperature and of higher barometer.

"The sandy loam contained in the 7 ft. of soil when completely filled with water, 29.61 in.; it lost by percolation 6.339 in. and retained 23.271 in. The clay soil began the trial with 37.17 in.; it lost during the 60 days 3.147 in. and still retained 34.023 in. in the 7 ft. The sandy loam could retain in its surface foot after 60 days, percolation without evaporation 2.83 in. and the clay soil 4.565 in. of water."

For the observations on evaporation 2 sets of cylinders of 2 each were filled with sandy loam and clay soil in the manner described above. "The sandy loam contained, when put in, 18.88 per cent of water and the clay soil 32.63 per cent. After the 4 tubes had been filled the soil was removed from one of each set to a depth of 3 in. and as much returned as a loose mulch as was required to again fill the tubes level full."

The tubes were placed in a ventilating shaft and a continuous draft of air was maintained across their surfaces from November 26, 1898, to October 6, 1899. At the end of that period the tubes were sawed off in 6 in. sections and the distribution of moisture in the columns determined with the following results:

Loss of water by surface evaporation from columns of soil 10 feet long, mulched and not mulched.

	Sandy loam.		Clay soil.	
	Mulched 3 in.	Not mulched.	Mulched 3 in.	Not mulched.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Surface 6 in	8.83	7.41	17.66	7.79
6 in. to 12 in	12.97	14.48	24.59	18.30
12 in. to 18 in	14.59	14.70	26.58	21.46
18 in. to 24 in	15.25	14.96	26.95	26.26
24 in. to 30 in	15.55	15.53	27.45	26.89
30 in. to 36 in	15.89	16.17	27.92	27.16
36 in. to 42 in	16.22	16.33	27.94	27.61
42 in. to 48 in	16.29	16.33	28.24	27.64
48 in. to 54 in	16.58	16.10	28.46	27.28
54 in. to 60 in	17.07	16.76	28.47	28.23
60 in. to 66 in	17.05	17.31	28.87	27.79
66 in. to 72 in	17.26	17.43	28.70	28.05
72 in. to 78 in	17.56	17.79	29.24	28.93
78 in. to 84 in	17.78	17.88	29.28	28.31
84 in. to 90 in	17.94	17.85	29.35	28.32
90 in. to 96 in	17.96	17.67	29.79	28.80
96 in. to 102 in	18.25	18.05	30.32	29.14
102 in. to 108 in	18.67	18.09	31.15	29.16
108 in. to 114 in	18.53	18.63	30.47	29.33
114 in. to 120 in	19.21	19.95	31.25	29.46

"It is clear from this table that there has been an upward movement of water and loss through the surface even from the bottom layers of soil in the case of the medium clay, and probably also from the sandy loam. . . .

"It is certain that a drying of these soils has taken place through a depth of 10 ft., and hence that moisture 10 ft. below the surface of the ground may become available for vegetation purposes at or near the surface."

It is not certain, however, that this upward movement of water is due entirely to capillarity. It is suggested that "it may be found that internal evaporation takes place in soils allowing water to pass up through the soil pores of drier soils by gaseous diffusion and condense on the colder soil grains higher up. If this is true, then these observations do not prove that there is danger of capillary rise of

alkalis from depths as great as 10 ft." It is the author's belief, however, "that the changes observed and recorded for the 10 ft. columns were largely if not wholly due to capillarity."

The utilization by plants of the potash dissolved in soil water, T. SCHLOESING (*Compt. Rend. Acad. Sci. Paris, 130 (1900), pp. 422–424; abs. in Chem. Centbl., 1900, I, No. 12, p. 686*).—The studies on soil-soluble potash reported in this article were of the same character as previous investigations on soil-soluble phosphoric acid (E. S. R., 11, p. 821). It is shown that the soil potash is dissolved only in very small amounts by the water of the soil, even when present in large amounts. It is stated that in a soil containing from 3,000 to 4,000 kg. of potash per hectare there will be only from 1 to 5 kg. of potash soluble in water at any given time. However, this potash gradually becomes available as required by the plant, and the author's experiments with corn showed that this plant was able during its growing period to obtain a sufficient amount of potash for a very large growth from a soil which showed only a very small amount of potash at any given time.

Catalogue of the first four thousand samples in the soil collection of the Division of Soils, M. WHITNEY (*U. S. Dept. Agr., Division of Soils Bul. 16, pp. 145*).—The bulletin explains the agencies through which the collection was obtained, describes the typical areas and formations represented, and gives reference to mechanical or chemical analysis. The collection includes samples from all of the States and Territories of the United States, except Maine and Wyoming, and from Bermuda, China, Cuba, England, Germany, Mexico, Russia, and Sumatra. The main object of the catalogue is stated to be to call attention to the large number of samples at present in the possession of the Division of Soils with a view to extending the collection by cooperation or exchange with individuals, organizations, and institutions interested in the subject.

"In order to call attention still more forcibly to the importance and value of the soil collection, and to extend this educational work, collections of representative soils are being put up in small glass bottles, arranged in boxes with 22 compartments in each. These sets are to be distributed to the agricultural colleges and experiment stations, with explanatory text regarding the origin, the chemical and physical peculiarities, and the agricultural value of the samples, together with a statement of the physical and chemical analysis of each."

Treatment of swamp or humus soil, F. H. KING and J. A. JEFFERY (*Wisconsin Sta. Rpt. 1899, pp. 244, 245, fig. 1*).—This is a brief summary of results of investigation on this subject which are reported in detail elsewhere (p. 32).

A method of ascertaining the fertility of different parts of an experimental field by the use of control plats, J. P. D'ALBUQUERQUE (*West Indian Bul., 1 (1900), No. 2, pp. 187–193*).

Readings of soil thermometers (*New York State Sta. Rpt. 1898, pp. 578–584*).—This is a tabular record of tridaily readings of soil thermometers during 1898 at depths of 1 to 18 in.

New problems in soil inoculation, J. STOKLASA (*Deut. Landw. Presse, 27* (*1900*), *No. 17, pp. 189–191; abs. in Chem. Ztg., 24* (*1900*), *No. 24, Repert., p. 86*).—The author found that the Alinit bacteria assimilated the free nitrogen of the air, but only in the presence of an excess of carbohydrates and with the assistance of a bacillus which occurs particularly in humus soils. The latter organism was isolated and studied.

FERTILIZERS.

The utilization of stable waste, W. H. BIRCHMORE (*Jour. Soc. Chem. Ind., 19* (*1900*), *No. 2, pp. 118–121*).—The author concludes from his observations and experiments that the fertilizing value of stable waste depends largely if not entirely upon the activity of the micro-organisms in the manure or in the soil to which it is applied. It was found that "an average sample of stable waste lost 40 per cent of its contained nitrogen in the first 2 hours after it was swept into the pit. Of this loss full three-quarters was in the fourth half hour." The author succeeded in preparing cultures which on being introduced into the manure heap set up an acid fermentation which prevented the loss of ammonia. The method of procedure was as follows:

"The stable waste, solid and fluid, as it accumulated, was collected in a closed and acidulated receptacle. Into this was turned a certain amount of a culture,[1] which in a very short time reduced the whole to a mud containing nitrates, ammoniacal salts, and phosphates, together with a relatively pure culture of certain organisms.

"This material, which has a peculiar sour smell, may be mixed with ashes and allowed to ferment with free access of air, a pure culture or a quasi-pure culture of other organisms being added, or in place of this some well-advanced material from a portion of waste already well 'worked.'

"If a relatively pure culture be used, the entire mass is reduced to a black loam within a very short time, and this loam I have used for cultivating plants with great success. Plants grown in it show reproductive bodies of exaggerated size as compared with the size of the plants by which they are produced."

The author isolated from soils different groups of organisms which it is claimed are essential, one for the growth of cereals, another for potatoes, a third for grass. Unless the particular organisms favoring the growth of the crop under cultivation are present in the soil the application of stable waste will not be effective in increasing the yield.

Investigations on the influence of nitric nitrogen and ammoniacal nitrogen on the growth of maize, P. MAZÉ (*Ann. Inst. Pasteur, 14* (*1900*), *No. 1, pp. 26–45; abs. in Jour. Agr. Prat., 1900, I, No. 11, pp. 382–388; Chem. Centbl., 1900, I, No. 12, p. 687*).—In these investigations it was found that corn assimilated these 2 forms of nitrogen with equal facility, if furnished in suitable proportions. The best results were obtained with a 0.2 per cent solution of nitrate and a 0.05 per cent solution of ammonium sulphate. A 0.2 per cent solution of ammonium sulphate killed the plants. The injurious effect of ammo-

[1] The nature and method of preparation of this culture is not explained.

nium sulphate sometimes observed in practice is believed by the author to be due to the use of too large amounts of the salt. Damp weather favors the beneficial effect of ammonium salts by diluting the soil solutions, and dry weather increases its injurious effects by concentrating them. The general conclusion is drawn that ammonia is just as effective as a fertilizer as nitric nitrogen, but that it must be used with caution.

Experiments on the preservation of barnyard manure, M. Hoffmann (*Deut. Landw. Presse, 27 (1900), No. 29, pp. 354, 355*).—An account is given of tests of Sulfarin, a commercial preparation in which the preservative agent is sulphuric acid (15 to 18 per cent).

The question of the preservation of barnyard manure, J. Koenig (*Fühling's Landw. Ztg., 49 (1900), Nos. 7, pp. 273–276; 8, pp. 290–295*).—This is a popular discussion of this subject, based upon investigations by the author and others, in which it is claimed that the best results will be obtained in the management of manure by protection from access of air, rain, and sun, and by thorough rotting.

On the construction of practical manure pits, H. Struwe (*Deut. Landw. Presse, 27 (1900), No. 37, pp. 454, 455, figs. 10*).—Plans and instructions for the construction of different kinds of pits are given.

Practical results of experiments in sewage treatment, T. W. H. Garstang (*Public Health, 12 (1900), No. 8, pp. 612–622*).

Report on the Government guano islands for the year 1899, C. H. Jackson (*Agr. Jour. Cape Good Hope, 16 (1900), No. 8, pp. 485–489*).—Statistics of collection and shipments of guano from the Colonial and Ichaboe Islands are given, and the price, extent of use, and possible future output are discussed. In 1899 the Colonial Islands produced 2,801 tons of guano, the Ichaboe Islands 2,211 tons.

Commercial fertilizer calendar for the year 1900, M. Ullmann, editor (*Notiz-Kalender über die Anwendung künstlicher Düngemittel für das Jahr 1900. Hamburg: J. H. Koch & Co., 1900, pp. 48*).

The composition and use of fertilizers, L. L. Van Slyke (*Pennsylvania Dept. Agr. Bul. 55, pp. 132*).—A revised edition of Bulletin 94, new series, of the New York State Station (E. S. R., 7, p. 853).

Analysis of commercial fertilizers sold in Maryland, H. B. McDonnell et al. (*Maryland Agr. Col. Quart., 1900, No. 7, pp. 67*).—This bulletin discusses the composition of plants, the nature and source of various fertilizing materials, the value of plant and soil analysis for determining the fertilizer requirements of soils, the market price and valuation of fertilizers, and home mixing of fertilizers; and gives tables showing the census statistics (1860–1890) of fertilizer production in the United States, the average composition of the more important fertilizing materials and of farm manures, the fertilizing constituents of feeding stuffs and farm products, the amount of plant food remaining in different kinds of soil 6 years after the application of various fertilizers, the amount of fertilizing materials contained in different crops grown on 1 acre, and analyses and valuations of 328 samples of fertilizing materials examined at the college from August, 1899, to January, 1900, inclusive. There are also given the text of the State fertilizer law and a supplementary list of fertilizers licensed for sale in Maryland for the year ended February 1, 1900.

Analyses of commercial fertilizers, W. F. Hand et al. (*Mississippi Sta. Bul. 61, pp. 15*).—This bulletin reports analyses and valuations of 48 samples of fertilizers collected during December, 1899, with some incidental explanation.

Fertilizer analyses, B. W. Kilgore (*Bul. North Carolina State Bd. Agr., 21 (1900), No. 4, pp. 22*).—This bulletin gives notes on valuation, freight rates from the seaboard to interior points of North Carolina, a list of fertilizers registered during

1900 (with guaranteed composition), and analyses and valuations of 181 samples of fertilizers examined by State chemist during the spring of 1900.

Analyses of commercial fertilizers, J. HAMILTON and W. FREAR (*Pennsylvania Dept. Agr. Bul. 54, pp. 163*).—This includes the text of the State fertilizer law, notes on valuations, a list of manufacturers securing licenses for the sale of fertilizers in Pennsylvania in 1899, and tabulated analyses and valuations of 716 samples of fertilizers examined during the year 1899.

Analyses of commercial fertilizers, H. J. WHEELER and B. L. HARTWELL (*Rhode Island Sta. Bul. 60, pp. 39-48*).—This is the third of the bulletins of this station dealing with the inspection of fertilizers in Rhode Island during 1899. It includes analyses and valuations of 47 samples of mixed fertilizers and 9 samples of wood ashes. The comparative quality of the complete fertilizers sold in the State from 1891 to 1896 and in 1899 was as follows:

Comparative quality of fertilizers sold in Rhode Island.

	1891.	1892.	1893.	1894.	1895.	1896.	1899.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Equal to or above the guaranty	71.1	80.7	75.7	80.9	89.0	90.7	84.9
Less than 0.3 per cent below the guaranty	10.6	9.0	13.8	8.0	5.0	4.8	6.9
More than 0.3 per cent below the guaranty	18.3	10.3	10.5	11.1	6.0	4.5	8.4

Report of fertilizer department, J. P. SMITH (*South Carolina Sta. Rpt. 1899, pp. 32-34*).—A brief account is given of the work of sampling and inspecting fertilizers during the year ended December 31, 1899. According to the reports of the official inspectors, the amount of fertilizers sold in the State during 1899 was 241,299 tons as compared with 257,393 tons sold in 1898. Analyses of the 336 samples of fertilizers examined during the year have been published in bulletins of the station (E. S. R., 11, pp. 438, 831).

Report of chemist, M. B. HARDIN (*South Carolina Sta. Rpt. 1899, pp. 9-16*).—This is a brief statement of the work of this department of the station during the year ended November 30, 1899. It includes notes on farmers' institutes, fertilizer inspection, examination of water, and miscellaneous analytical work.

"Of the 336 samples [of fertilizers] analyzed this year only 6 were deficient under the law, which requires that the commercial value based upon analysis shall not fall 3 per cent below the commercial value based upon guaranty. Besides these 6 deficients, however, there were 56 samples, including 1 cotton-seed meal, which fell below guaranty in one or more constituents."

Analyses of licensed commercial fertilizers, 1899, F. W. WOLL and A. VIVIAN (*Wisconsin Sta. Rpt. 1899, pp. 263-266, 316, 317*).—A brief account of fertilizer inspection in Wisconsin during 1899, analyses of 5 fertilizers being reported. The text of the fertilizer law is given.

Analyses of commercial fertilizers obtainable in New South Wales, F. H. GURNEY and T. H. LABY (*Agr. Gaz. New South Wales, 11 (1900), No. 4, pp. 290-294*).—This article discusses the valuations of fertilizers in New South Wales and gives analyses and valuations of 110 samples of fertilizing materials, including various mixed fertilizers, and deposit from wool-scouring tanks, wool waste, "skutch" from limed pelts, decomposed hair and lime, tanyard refuse, sheep manure, bat guano, filter-press muck from cane mills, megass, megass ash, bloodwood ash, ironbark, blackbutt ash, red gum ash, spotted gum ash, boxwood ash, seawood ash, ash of kerosene shale, cave deposit, gypsum, flue deposit from furnaces, night soil, fowl manure, ash of vine cuttings, and seaweed.

Recent researches on nitrification, R. WARINGTON (*Chem. News, 81 (1900), No. 2105, p. 151*).—This is an abstract of a lecture reviewing recent work on this subject, especially that of Winogradsky and Oméliansky.

FIELD CROPS.

The influence of the right amount and right distribution of water in crop production, F. H. KING (*Wisconsin Sta. Rpt. 1899, pp. 206–213, figs. 3*).—This is a continuation of work already reported (E. S. R., 11, p. 537). An introductory statement is made of the rainfall at the station during the growing season of 1899. The season was not as favorable for crop production as the preceding one as regards distribution of rainfall, although in general excellent results were obtained.

The clover of the experimental plats having been winterkilled, reseeding became necessary. Oats were used as the first crop and clover as the second. The total yield per acre for the 2 crops is tabulated, and the results obtained are compared with those of the 3 preceding years.

Corn was thickly planted for the sixth successive year on the same plat with irrigation, but without application of fertilizers, the aim being to exhaust the soil by cropping as rapidly as possible. The yields for the years 1894–1899, inclusive, are tabulated.

"The yield on the unirrigated ground is the smallest of any but the very dry year of 1895, and that on the irrigated ground is on the average the smallest of any year and only barely equal to that not watered. The corn was very yellow compared with that on other plats and evidently starved, although in the spring the soil showed more nitric acid than was found [in the plat referred to in the next paragraph], and the physical condition of the soil is if anything better than it was in 1894. It appears clear that the feeding capacity of the soil has very much decreased, and yet by standard methods of chemical analysis of soil for available plant food we started in 1894 with enough for heavy crops for more than half a century."

Dent corn was grown in alternate plats, irrigated and unirrigated. The irrigated plats were watered twice. They yielded 10,990 lbs. of dry matter per acre, while the unirrigated plats yielded but 7,985 lbs., showing a difference of 3,005 lbs. or 37 per cent in favor of irrigation.

In the work with potatoes, 4 methods of culture were used: Ridge culture with irrigation, ridge culture without irrigation, ridge culture with straw mulch between the rows, and level culture without irrigation. With Salzer Harvest King, irrigation produced 411.3 bu. per acre, mulching without irrigation produced 343.3 bu., and ordinary ridge culture, 346.7 bu.

"Watering the potatoes twice increased the yield per acre 61.1 bu. of merchantable tubers over the not watered and 59.4 bu. over those mulched with straw. In this case it is clear that the potatoes needed more water than the rainfall of the season, but that the straw mulch did not materially increase the yield over that of the unirrigated subplats."

Determinations of the amount of moisture in the soil of each plat made before the first irrigation showed little difference between the plats in this respect. Similar determinations made 3 days after the last irrigation gave results as follows:

Moisture in soil of potato plats.

	Irrigated.		Unirrigated.		Mulched.	
	Moisture.	Soluble salts per acre.	Moisture.	Soluble salts per acre.	Moisture.	Soluble salts per acre.
	Per cent.	*Pounds.*	*Per cent.*	*Pounds.*	*Per cent.*	*Pounds.*
First foot	17.30	34.37	10.51	39.69	10.17	35.28
Second foot	13.80	49.33	12.38	52.33	12.13	41.12
Third foot	14.29	25.81	11.98	29.01	14.68	32.34
Fourth foot	13.42	18.03	13.15	19.23	13.07	21.42

"On this date the irrigated soil was markedly more moist than the other 2, but there was not much difference between the unirrigated and mulched soils. It will be seen that the irrigated soils contain the least amount of soluble salts and the mulched most, except in the bottom foot."

Comparisons were made of hill culture with irrigation with hill and level culture without irrigation. As between hill and level culture without irrigation, there was relatively little difference in the yield, the latter giving 9.1 bu. of large tubers per acre more than the former, but more of the potatoes being greened in level culture. In the case of the irrigated potatoes there was an increased yield of 114 bu. of large tubers per acre over the hilled potatoes not irrigated and 108 bu. per acre over those receiving level culture without irrigation.

Seven days after the last irrigation determinations were again made of the amount of moisture in the soil of each plat, this time of the amount in and between the rows respectively. The irrigated plat contained about 6 per cent more water in the surface foot of soil under the hills and 8 per cent more between the rows. The second foot of soil contained about 2 per cent more water than the unirrigated plats. With this increase in amount of soil water is associated an increased yield of about 100 bu. of merchantable potatoes to the acre. "This relation makes it very clear that the right amount of water at the right time is a very important factor in determining the yield. The amount of water which was added to the soil this year to secure this increase in yield was only about 2 acre-inches, divided between 2 irrigations."

Continued effects of fertilizing the soil, W. C. LATTA (*Indiana Sta. Rpt. 1899, pp. 46–50*).—Corn has been grown continuously since 1880 on plats fertilized with either horse manure, gas lime, or ammoniated phosphate to study the residual effects of these manures. The yields of grain and stover on the different plats are given for 10 years for the gas lime and phosphate plats, and for 16 years for the horse-manure plats.

The results show the effects of the lime and ammoniated phosphate on grain yield to be slight and transient. The aggregate increase of corn due to the residual effects of the horse manure has amounted to 131.8 bu. of grain and 6,242 lbs. of stover, estimated to be worth $55.14.

The average increase of grain in 1898 attributed to the original application of horse manure was 3.17 bu. per acre.

Variety tests of grains, R. A. MOORE (*Wisconsin Sta. Rpt. 1899, pp. 246–248*).—Tests were made of several varieties of oats and barley and one variety each of Russian spelt and Russian millet. A part of the oats and barley were from Canada. All others were imported from Russia by this Department. Wisconsin Mandscheuri barley was compared with the same variety as grown in Canada, to determine whether the seed had lost any of its vitality since being grown in Wisconsin, and also to compare it with some of the newer varieties. The results of this and some other parts of the test were as follows:

"The test shows that the Mandscheuri barley is reliable seed and is especially adapted to our soil and climate.

"The Oderbruker barley, which, like the Mandscheuri, is a six-rowed barley, gave the largest yield per acre, but was somewhat lighter in weight per measured bushel. These two varieties grew more vigorous and the straw was brighter and stronger than in other varieties tested.

"Of the oats tested, the Siberian and Daubeney gave the best yield per acre of grain, and the Russian No. 2800 the best yield of straw. The Daubeney oats ripened earlier and more evenly than the other varieties, and while the yield of straw was less, it was of an extra fine quality.

"The Russian spelt did not thrive well, and did not produce a good crop of either grain or straw. It does not seem to be well adapted to our conditions, as the warm weather in summer materially affects it."

The growth of the millet was rapid, and a large amount of hay could have been secured if it had been cut at the proper time. The object of the test, however, was to secure seed. Russian vetches were found to be a promising crop, growing luxuriantly and producing a large amount of fine green forage.

Machine and hand-threshed cereals for seed, H. C. SCHELLENBERG (*Landw. Jahrb. Schweiz., 13 (1899), pp. 152–168*).—The author's experiments along this line with rye, wheat, spelt, and barley show that the losses for seed purposes due to threshing by machinery were $\frac{3}{10}$ with rye, $\frac{1}{4}$ with wheat, and $\frac{1}{6}$ with barley of the total grain yield. With rye and wheat this was 3 times as great a loss as resulted from the use of the flail, and with barley twice as great. These losses were considerably increased in each case when the seed was treated with a solution of copper sulphate before planting. In general the larger seeds were the ones most injured by threshing. With spelt, only one-fourth of the machine-threshed grain was available for seed purposes.

The nitrogen fertilization of barley for brewing, T. REMY (*Bl. Gersten- Hopfen- u. Kartoffelbau, 1 (1899), No. 1, pp. 9–36*).—Pot experiments in fertilizing barley with different forms and amounts of nitrogen are reported. The moisture content of the pots was varied in some instances. From the results obtained it is shown that nitrate of soda and sulphate of ammonia are more completely used up by the

barley crop than more slowly acting organic forms of nitrogen, as guano and poudrette, since the taking up of nitrogen by this crop is largely confined to the earlier stages of growth. The use of the former compounds of nitrogen, especially nitrate of soda, tends toward an increase of the nitrogen content of the grain, an undesirable feature in barley intended for brewing purposes. When nitrate of soda is used instead of guano, it should be applied in smaller amounts. Nitrate of soda was found especially valuable, as compared with other nitrogen fertilizers, in dry soils. As to the time of application of fertilizers, the author believes that nitrate of soda should be given in 2 applications and not later than the beginning of the stooling of the barley. Sulphate of ammonia and all other forms of organic nitrogen should be applied shortly before the seeding of the barley.

Report on culture experiments with barley at the Berlin Experimental Institute for Brewers, von Eckenbrecher (*Bl. Gersten-Hopfen- u. Kartoffelbau, 1 (1899), No. 5, pp. 133–149*).—The details of cooperative field experiments in fertilizing barley with different forms of nitrogen are reported. The data given show the fertilizers applied, yield of grain and straw, weight of 1,000 grains, protein content of the grain, and the comparative value of the grain grown with the different fertilizers. The best barley as regards quality was grown without any nitrogenous fertilizer, and the poorest with guano. The yields of grain and straw and weight of the grain averaged highest on the plats receiving nitrate of soda. The protein content of the grain did not seem to be materially affected by the different fertilizers.

The influence of heredity upon vigor in the potato, E. S. Goff (*Wisconsin Sta. Rpt. 1899, pp. 304–308, fig. 1*).—A report is made on experiments begun by the author in the spring of 1884 while he was connected with the New York State Station,[1] in the selection of seed potatoes for prolificacy. Comparisons were made year after year of the prolificacy of tubers selected from the most productive and least productive hills. The method of preparing the tubers for planting was to cut the larger tubers to single eyes just before planting in order to eliminate to a large degree the inequality of size in the two lots of tubers. In 1898 the method was somewhat modified in order to further eliminate the inequality that arises from the fact that the tubers from the most productive hill almost always average larger than those from the least productive hill.

The total yield of the most productive hill of Old Long Mercer for 2 years was 63$\frac{15}{16}$ oz.; that of the least productive hill, 41$\frac{3}{16}$ oz. Similarly, the total yield of the most productive hill of Snowflake for 2 years was 332$\frac{1}{8}$ oz., and the yield of the least productive hill for the same time 100$\frac{1}{4}$ oz.

[1] New York State Sta. Rpt. 1887, p. 85.

"Adding the total yields of the most productive hill of the varieties together, and subtracting from this sum the same total for the least productive hill, it appears that the actual excess in yield of the seed from the most productive hills was a trifle over 180 per cent. It is difficult to explain this difference in yield on any other hypothesis than the difference in the inherent vigor of the samples of seed planted. It must be remembered that the weight of the seed planted was the same, that the conditions of growth were the same, and that the method of selection was rather against the most productive hills, because while the largest tubers from the least productive hills were used for seed, the majority of the largest tubers from the most productive hills were rejected.

"This experiment has not tended to increase the yield of the varieties used, because the most productive hills were continually hampered by having the seed tubers cut up fine to keep them comparable to the least productive hills. It demonstrates the increased vigor of the most productive hills and nothing more.

"It is believed that these experiments, reaching as they do through 14 years, are sufficient to demonstrate the principle that vigor in the potato plant, as in other plants, may be maintained and increased by selection. The potato grower may doubtless prevent the failure of his varieties by the method of seed selection indicated in this article. Where the digging machine is employed, the best way to carry out the plan would be to grow a plat of potatoes each year on the best soil, to be used expressly for seed selection, and to dig this plat by hand. The selected tubers from this plat could be used the next season to produce the seed for the main crop the following year. This is substantially the method practiced by seed growers in maintaining the vigor and purity of their seeds."

Tests of the sugar beet in Pennsylvania, H. P. ARMSBY and E. H. HESS (*Pennsylvania Sta. Bul. 47, pp. 8*).—A continuation of work with sugar beets previously reported (E. S. R., 10, p. 40). Eleven varieties were tested. Tabulated data as to average size of beets, sugar content, and percentage of purity are given for beets grown in 33 counties, and these data are summarized for the more important sugar-beet districts of the State. A study was made of the best time of harvesting. The average weight of the beets grown in the entire State was 1.33 lbs.; average sugar content, 12.66 per cent; and average percentage purity, 81.8. About the last of October or first of November is considered the most suitable time for harvesting sugar beets in Pennsylvania. Original Kleinwanzlebener and Troensegaard Elite were the 2 best varieties grown.

Test of corn-cultural implements, W. C. LATTA (*Indiana Sta. Rpt. 1899, pp. 51-53*).—The relative value of a number of different makes of cultivators for corn have been tested at the station continuously for 11 seasons. The results thus far obtained, in the opinion of the author, seem to justify the following conclusions: "(1) The kind of implement is not so important as thoroughness and carefulness in using the same. (2) In well-drained soils, deeply broken and well filled with humus, deep culture of the corn crop does not seem necessary at any stage of its growth."

Report on experiments in 1899, J. R. DUNSTAN (*Agr. Dept. Univ. Col., Nottingham [and] Midland Dairy Inst., 1899, pp. 35*).—Report on cooperative manure and variety experiments with potatoes, barley, and grass; on spraying charlock; and on rotation, manure, and cropping experiments.

New contribution to the question of the influence of the water content of the soil on the development of the plant, C. VON SEELHORST (*Jour. Landw., 48 (1900), No. 2, pp. 165-177, pls. 2*).—A study of the influence on the form and composition of oats and spring wheat of varying amounts of water in the soil and of increasing and decreasing the water content of the soil at different stages of growth.

Action of sulphuric acid employed in watering clover and sugar beets, A. DAMSEAUX (*Bul. Agr. [Brussels], 15 (1899), No. 7, pp. 619, 620*).—In these experiments the plants were watered with a solution containing 24 gm. of sulphuric acid to each liter of water. The results were positive. The production of stems and leaves was diminished and the constitution of the plants modified. In the case of the clover the yield was much reduced by the use of the acid. With sugar beets the total yield and the percentage of sugar were both reduced. The quotient of purity was slightly raised and the percentage of sulphuric acid in the ash almost doubled.

Russian cereals adapted for cultivation in the United States, M. A. CARLETON (*U. S. Dept. Agr., Division of Botany Bul. 23, pp. 42, pls. 2, figs. 2*).—A general discussion is given of the characteristics of Russian and American grain soils, climatic conditions of the grain belts of the two countries, etc., with notes showing the cultural methods followed in Russia, and other data on each of 7 varieties of wheat, 3 of oats, 2 of barley, 2 of emmer, 6 of millet, and 1 each of Indian corn, buckwheat, Tambof flat pea, and *Polygonum weyrichii*, recently secured from Russia for trial in this country, and similar data on a number of other varieties of wheat and oats now being introduced. Descriptive notes as to Russian methods of harvesting, threshing, cleaning, and milling wheat are included in the bulletin, as is also a list of Russian cereals already grown in this country, notes on the preparation of cereal foods in Russia, and suggestions regarding the requirements of a proper test of new cereals.

Cotton, H. LECOMTE (*Le coton. Paris: J. B. Baillière & Sons, 1900, pp. 496, figs. 37*).

The manuring of cotton, G. P. FOADEN (*Jour. Khedir. Agr. Soc. and School of Agr., 2 (1900), No. 2, pp. 87-91*).—The use of barnyard manure increased the yield of cotton, but decreased the quality of the staple. Medium applications of poudrette gave profitable returns, yielded a higher proportion of fiber in ginning, and produced superior cotton. Experiments in the use of guano did not give conclusive results.

Culture experiments with German, English, and French fodder beets (*Landw. Wchnschr. Sachsen, 2 (1900), No. 18, pp. 159, 160*).—Tests of 10 German, 6 French, and 4 English varieties of fodder beets are reported. Yellow Eckendorfer, Yellow Tannenkrüger, and Red Eckendorfer of the German varieties, in the order named, have given the best results.

Experiments with fodder beets, P. THIELE (*Fühling's Landw. Ztg., 49 (1900), Nos. 4, pp. 143-146; 5, pp. 185-187; 6, pp. 207-209*).—Variety and distance experiments are reported. Yellow Tannenkrüger and Yellow Eckendorfer gave the best yield of 11 varieties grown. Rows 14 in. apart gave better results than rows 12 in. apart.

Forage crops, W. B. ANDERSON (*Indiana Sta. Rpt. 1899, pp. 59-66*).—Notes on the culture and yield of the following forage plants grown at the station during the season: Corn, Kafir corn, sweet sorghum, Dwarf Essex rape, soy beans, cowpeas, field peas, vetches, and combinations of Canada field peas and oats. Cooperative experiments with some of these plants were carried out by farmers in different parts of the State, the results of which are briefly noted.

Forage crops other than grasses; how to cultivate, harvest, and use them, T. SHAW (*New York: Orange Judd Co., 1900, pp. 287, figs. 29*).—The author tells how to cultivate, harvest, and use for the purposes of forage, corn, sorghum, non-saccharine sorghums, plants of the clover family, other leguminous plants, rape, cabbage, the common cereals, millet, root crops, and miscellaneous plants. Chapters are given on successions of crops for continuous forage throughout the season in each of the different sections of the United States, and on sheep pastures at the Minnesota University Experiment Farm.

Fertilizer experiments with hops (*Bl. Gersten- Hopfen- u. Kartoffelbau, 1 (1899), No. 9, pp. 322–330*).—Summarized results obtained by the German Hop Culture Association in 1898.

Fertilizer experiments with hops, T. REMY (*Bl. Gersten- Hopfen- u. Kartoffelbau, 1 (1899), No. 10, pp. 341–362*).—Report on the use of different nitrogenous fertilizers for hops. The experiments were made at the Experimental Institute for Brewers in Berlin and, in cooperation with the institute, by growers in different hop districts in Germany. Barnyard manure was one of the best fertilizers used. Sulphate of ammonia and nitrate of soda proved good substitutes for this manure. Large amounts of potash in one experiment seemed to increase the total ether extract and resin content of the hops grown.

Notes on five years' experiments on hop manuring, B. DYER (*London: Vinton & Co., Ltd., 1900, pp. 21, figs. 12*).—The object of these experiments has been "to ascertain how far nitrate of soda in the presence of an abundant supply of phosphates and potash can be advantageously used as a source of nitrogenous food for hops." Increasing amounts from 200 up to 400 lbs. per acre were used. The hops grown were examined independently by a brewing chemist and a commercial hop dealer, and their relative values judged. In no instance did the use of nitrate affect the quality of the hops injuriously. On the other hand, it considerably increased the total yield of hops, and had a decidedly beneficial effect on their quality as compared with hops grown on plats which received no nitrate. The author believes that on soils otherwise liberally manured 400 lbs. per acre of nitrate of soda is a perfectly safe dressing for hops. In the author's experience 600 lbs. per acre has given the best results in a dry year.

Culture of legumes, C. FRUWIRTH (*Anbau der Hülsenfrüchte. Berlin: Paul Parey, 1898, pp. 274, figs. 69*).—This is another contribution to the series of Thaer-Bibliothek agricultural books. The work is confined to podded plants such as beans, peas, and the like. The general part of the book treats of the botany of legumes, structure and development of the plant and seed, requirements as regards soil and fertilizers, basic principles in the culture of legumes, statistics of legume culture, uses of legumes, and place of legumes in a system of rotation, and as a salable seed crop. The special part, occupying little more than half of the book, is devoted to considerations of the botany, characteristics, culture, and uses of 24 species and varieties of legumes.

The present status of rice culture in the United States, S. A. KNAPP (*U. S. Dept. Agr., Division of Botany Bul. 22, pp. 56, pls. 3*).—This bulletin notes briefly the history of rice and its introduction into the United States, and gives in detail methods of rice culture in South Carolina, Georgia, Louisiana, and southeast Texas, dealing especially with systems of irrigation and the use of the gang plow, disk harrow, drill and broadcast seeder, and twine binder as applied to rice culture in southwest Louisiana and southeast Texas.

Historic and modern methods of milling rice are discussed, as well as the uses of rice and its by-products, soils adapted to rice culture, prospects for the extension of the industry in the United States, and the culture of rice in Asia and the Pacific Islands. Much statistical matter relative to imports of rice, production in the United States, etc., is also included in the bulletin.

Wild rice in Minnesota and Wisconsin, A. E. JENKS (*Amer. Thresherman, 3 (1900), No. 2, pp. 18–54, figs. 9*).—Methods followed by the native Indians in sowing and harvesting wild rice in these States are given.

Sugar-beet investigations in Wisconsin during 1898, F. W. WOLL (*Wisconsin Sta. Rpt. 1899, pp. 249–262, fig. 1*).—The data of this article have already appeared in Bulletin 71 of the station (E. S. R., 11, p. 143).

Culture of sugar beets in Egypt, G. P. FOADEN (*Jour. Khediv. Agr. Soc. and School Agr., 2 (1900), No. 2, pp. 76–82*).—Brief review of the sugar-beet industry in Germany and France, with notes on the present status of the industry in Egypt.

Applying phosphatic manure to sugar beets in the row (*Deut. Landw. Presse, 27 (1900), No. 38, p. 472*).—The yields of sugar beets were considerably increased when fertilizers were applied in the seed row over applications made broadcast.

Influence of increasing quantities of phosphoric acid and nitrogen in the culture of sugar beets, A. DAMSEAUX (*Bul. Agr. [Brussels], 15 (1899), No. 7, pp. 616-618*).—Applying more than 700 kg. of superphosphate or 500 kg. of nitrate of soda in these tests was not profitable.

Sugar cane: Culture, manufacture, and statistics, W. TIEMANN (*Zuckerrohr: Kultur, Fabrikation, und Statistik. Berlin: Deutscher kolonial Verlag, 1899, pp. 58*).

Deep and shallow cultivation of cane in Audubon Park (*Louisiana Planter, 24 (1900), No. 18, p. 285*).—Shallow cultivation has given the best results. The author believes that this method of cultivation of cane in Louisiana would increase the yield of cane from 5 to 10 tons per acre.

The judging and culture of wheat for brewing purposes, T. REMY (*Bl. Gersten-Hopfen- u. Kartoffelbau, 1 (1899), No. 9, pp. 305-316*).

Field tests of varieties of wheat, covering nineteen years, W. C. LATTA (*Indiana Sta. Rpt. 1899, pp. 54-58*).—Tabulated data showing the average yield and the characteristics of the grain and straw of 178 varieties of winter wheat and 11 varieties of spring wheat tested at the station during the preceding 19 years, with notes and comments.

HORTICULTURE.

A study of the effect of incandescent gaslight on plant growth, L. C. CORBETT (*West Virginia Sta. Bul. 62, pp. 79-110, pls. 9, figs. 4, charts 7*).—This bulletin reports the results obtained in a series of greenhouse experiments carried on during the years 1895 to 1899 with lettuce, radishes, spinach, tomatoes, sugar beets, and seedling cabbage, mainly from an economic standpoint. Eight Welsbach incandescent burners were used in the experiments, and these were so alternated in position from time to time as to overcome local temperature and light differences. Plans of the greenhouse used and photographic, diagrammatic, and auxanometer records of the growth and development of the different crops form an important part of the bulletin. Weighings of the crops were made and the sugar beets grown analyzed. The character and quality of the arc and incandescent electric lights and Welsbach gaslight as compared with sunlight are discussed by the aid of figures.

The experiments with lettuce involved 12 distinct crops and nearly 10,000 plants. Transplanting the young plants from pots and using an artificial light only during the period the plant occupied the permanent greenhouse bench was adopted after comparative trials as being the best method for the growing of lettuce on a commercial scale. The plants grown in artificial light were taller, heavier, grew faster, and matured quicker than plants grown from the same lot of seed under normal conditions. In one experiment 400 plants exposed to the stimulating influences of the artificial light for 46 nights weighed 68.56 lbs., while a similar lot grown under normal conditions weighed 49.43 lbs., an increase in favor of the former of 38.7 per cent.

Radishes were grown between the rows of lettuce, as is commonly practiced in commercial houses. The artificial light notably increased the development of the tops of the radishes and slightly increased the size of the roots. The heliotropic effect of the incandescent light was greater with radishes than with any of the other plants grown. The stimulating influence of the incandescent light, on the other hand, was greatest with spinach. It caused the production of seed shoots in the row to a distance of nearly 8 ft. from the light. Spinach plants subject to the influence of the light grew faster and completed their growth in less time than plants grown normally.

The records of the yield and date of first bloom of tomatoes grown from seed and also from cuttings show no increase in weight of the fruit grown in the light, though the blossoming period was from 8 to 18 days earlier and the individual fruits were generally larger than when grown under normal conditions.

With sugar beets the tops, sugar content of the roots, and percentage of purity were considerably increased by the use of the incandescent gaslight. The largest and heaviest roots, however, were grown under normal conditions.

The range of stimulating influence of the incandescent light was studied.

"The range of light is somewhat variable for different crops. In general the maximum growth was attained at 12 to 16 ft. from the light, while a perceptible increase was noted at 24 ft.

"The stimulating influence of the light as indicated by the growth of plants used in the various tests is shown by the order in which the the sorts are named, the first being the most susceptible: Spinach, cabbage, radish, lettuce, tomato."

In a study of the periodicity of plant growth as modified by the influence of the artificial light it was found that the most active period of growth of lettuce subject to the influence of the incandescent gaslight began at 11 p. m. and continued until 9 a. m., while with the plants grown under normal conditions the most active period of growth began at 4 a. m. and continued until 11 a. m. In the first instance the period of growth was 10 hours and in the second 7.

In these experiments no injurious effects resulted from the use of incandescent gaslight.

The use of chemical fertilizers in the forcing house, W. STUART (*Amer. Gard., 21 (1900), No. 268, p. 94*).—This article summarizes the experience of the Indiana Station in the use of commercial fertilizers for forcing lettuce under glass. The results are at variance with those reported by A. T. Jordan (E. S. R., 11, p. 1039), the statement there made that "chemical fertilizers are of little use in the forcing house" being criticised.

In one test at the Indiana Station the soil used was composed of a black loam sod composted with one-fourth of its bulk of manure. The soil to which the commercial fertilizers were applied for comparison

was taken from underneath the sod used in the prepared soil just noted, "and was, therefore, poorer both in plant food and mechanical mixture." The author states that the leaves of the plants grown in the rotted sod and manure were softer, more leathery, and therefore less crisp and tender than those grown in the pots fertilized with the commercial fertilizers, and did not keep so well when marketed. "Plants grown in the prepared soil and manure averaged 157.7 gm. in weight, while those grown in the poorer soil with the addition of a liberal dressing of raw bone meal averaged 169.3 gm. per plant, an increase in favor of the latter of over 7 per cent."

In another experiment a pot of the same soil to which commercial fertilizers were added was mixed with an equal bulk of well-rotted manure. The average weights of plants grown under the different conditions are as follows:

"Soil and manure, 323 gm.; raw bone meal, 286 gm.; raw bone meal, nitrate of soda, and muriate of potash, 334 gm. The increased product from the third lot over that of the first, while only slight, is yet sufficiently marked to show the value of chemical fertilizers in the forcing house. . . . Our best results have been obtained with raw bone meal, nitrate of soda, and muriate of potash. The last 2 ingredients, because of their immediate availability, should be used in moderate amounts, and, in the case of nitrate of soda at least, should be applied in from 2 to 4 installments."

The effect of transplanting on time of maturity, F. CRANEFIELD (*Wisconsin Sta. Rpt. 1899, pp. 312-315*).—Tests were made to determine the correctness of the commonly accepted opinion that transplanting promotes earliness and increases yield. Trials were made with a number of vegetables both in the greenhouse and in the open field. Seeds of Grand Rapids lettuce were sown in a greenhouse on January 15. February 5 one-half of the plants were taken up and reset in the same places in the usual manner of transplanting seedlings. March 23 the entire crop was cut and weighed. The average weight of the plants not transplanted was 42.4 gm., while the average weight of the transplanted plants was only 36.4 gm., showing a gain of 16⅔ per cent in favor of the plants that were not transplanted.

In another trial cabbage seed was sown February 5. February 28 two-thirds of the plants were transplanted as in the previous trial, and March 8 one-half of the transplanted plants were again transplanted. May 3, 8 plants from each lot were cut and weighed. The plants that had not been transplanted weighed 4,214 gm. Those that had been transplanted once weighed 2,993.5 gm. and those that had been transplanted twice weighed 2,241.7 gm. "In this case the once-transplanted plants fell 28.9 per cent behind the not transplanted, and those twice transplanted fell 46 per cent behind the not transplanted. Several other trials were made in the greenhouse with lettuce and radishes, and all gave similar results."

In a similar way 3 crops of tomatoes were grown. In each case seeds were planted singly in flowerpots in the greenhouse. As in the

case of the cabbage, one-third of the plants were not transplanted, one-third transplanted once, and one-third transplanted twice. As soon as the weather permitted, 10 plants from each lot were taken from the pots and transferred to the open ground, every precaution being taken to avoid injury to the roots. The total yield of fruit in 3 years by the plants that had not been transplanted was 1,174.8 lbs. Those that had been transplanted once yielded 1,131.2 lbs. and those that had been transplanted twice 1,001.2 lbs.

In order to judge of the influence of transplanting on earliness, the ripening season was divided into 3 parts and the yield calculated separately for each part. During the first period the yield of the plants that had not been transplanted was 105.2 lbs. Those that had been transplanted once yielded during the same period 109.7 lbs., while those that had been transplanted twice yielded but 88.1 lbs.

Experiments were also made in the open field with cauliflower, kale, collards, and two varieties of cabbage, the results showing a gain in every case in favor of those plants that were not transplanted.

The conclusions, based on 3 years of experiment, are stated as follows:

"Lettuce and other plants in the greenhouse, when given sufficient room to develop and not transplanted, matured quicker and produced a greater yield than similar plants that had been transplanted. In the case of tomatoes there was a slight gain in earliness and yield in favor of the not transplanted plants, while those twice transplanted were very evidently injured. Cabbage and allied plants when grown wholly in the open ground were perceptibly injured by transplanting.

"The general conclusion drawn from this work is that transplanting does not promote earliness nor an increased yield. Once transplanting, as of cabbage plants, from the seed bed to the field, or 'pricking off,' as commonly practiced in the greenhouse, is necessary in order to economize room, but repeated transplanting of vegetable plants is not advisable."

Report of the horticulturist, A. L. QUAINTANCE (*Georgia Sta. Rpt. 1899, pp. 123-139*).—The effects of the freeze of February 13, 1899, on orchard fruits are discussed, and tables are given showing the results on 45 varieties of Japanese plums. As a whole, these suffered more than peaches, some being entirely killed. Figs and Japanese persimmons were killed to the ground. The injury to grapes was light, though the varieties Eden and Scuppernong were seriously injured. Apples, cherries, quinces, and native plums were not perceptibly injured by the freeze.

Tables are given showing the effect of ringing on 195 varieties of grapes, especially with reference to earliness and keeping qualities. The results for the season show that the time of keeping of 22 varieties was somewhat prolonged by ringing; with 60 varieties it was shortened from 1 to 7 days.

Brief notes are given on the growth of onions, sweet corn, celery, and asparagus. Applications of common salt did not increase the

yield of asparagus, and when 5 tons of kainit were applied per acre the yield was only slightly increased. The variety Palmetto gave the best yield of 4 varieties tested. The greatest yields with asparagus were obtained from plants set 18 in. apart in 4-foot rows. The shoots of these plants, however, were small, and for choice cuttings it is suggested that plants should not be set closer than 4 by 4 ft.

Field notes of horticultural department, C. B. WALDRON (*North Dakota Sta. Bul. 42, pp. 493–533*).—The influence of different fertilizers on the total yield and time of maturity of vegetables in the Red River Valley are reported for the years 1898 and 1899. The soil selected was typical of the whole valley. Different varieties of beets, onions, cucumbers, cabbage, lettuce, tomatoes, beans, radishes, peas, and carrots were grown, each being fertilized with a complete fertilizer, superphosphate, kainit, nitrate of soda, salt, lime, and stable manure, respectively. The results are recorded in 54 tables. In no case was there sufficient increase due to the fertilizers to warrant their application, and it is thought that the method of handling the soil has more to do with the production of vegetables in this valley than the application of fertilizers. Transplanting onions, even the ordinary sorts, proved profitable.

Preliminary report on experiments in pinching raspberry shoots, E. S. GOFF (*Wisconsin Sta. Rpt. 1899, pp. 275–282, pl. 1*).—Experiments made to ascertain to what extent the pinching of the tips of raspberry shoots promotes productiveness and increases the size of fruit are reported. In the first experiment 6 rows each of Cuthbert (*Rubus strigosus*) and Gregg (*R. occidentalis*) raspberries were used. "Two rows of each variety were left unpinched; two other rows had the shoots pinched as they attained the height of about 12 in.; the remaining two rows of each variety had the shoots pinched at about 12 in. high; and in addition the branches were pinched as they attained the length of about 12 in. from the main shoot." The result of the experiment was that the canes which were not pinched at all yielded slightly more than those that were pinched, the difference being rather the more noticeable with the Cuthbert variety.

To ascertain the effect of pinching the shoots on the size of the berry, 100 were taken by chance from each plat and weighed.

"The pinching appeared to increase the size of the fruit a little, especially in the Cuthbert variety.

"No difference could be observed in the different methods of pinching as to the susceptibility of the plants to disease. It was observed, however, that the shoots that were not pinched at all were killed back a little farther in winter than those that were pinched. The shoots appeared to be more numerous in the pinched than in the unpinched rows, and most numerous in the rows in which both the shoots and laterals were pinched. This indication was fully confirmed when one of the plantations was rooted out. The stumps from the unpinched rows showed the fewest stubs of canes, and those from the twice-pinched rows showed the most."

This experiment was not satisfactory for several reasons, and a second and more extended one was undertaken. Two-thirds of an acre was divided into 2 equal parts, one of which was planted to Gregg and the other to Cuthbert raspberries. Each of these plats was further subdivided into 3 plats.

"Each of these 3 plats was again subdivided into 3 smaller plats, containing 3 rows each. Each of these 3-row plats had 1 row that was left unpinched, 1 row of which the shoots only were pinched, and 1 row in which both the shoots and laterals were pinched. In the first plat of each variety, the shoots in the pinched rows were pinched at 12 in. high; in the second plat they were pinched at 18 in. high; and in the third plat at 24 in. high. Four shoots only were permitted to grow to each plant. The plantation was carefully gone over at frequent intervals and every shoot in the pinched rows was pinched at nearly the designated height. The superfluous shoots and suckers were removed from each row and either counted or weighed."

The results of the experiment indicated: "(1) That the high-pinched rows yielded more fruit than the low-pinched rows; (2) that the high-pinched rows yielded more fruit than the rows that were not pinched; (3) that twice pinching gave no advantage in yield over once pinching; (4) that the influence of the pinching is quite as marked in the Cuthbert variety as in the Gregg, and it seems to have been exerted in the same direction."

Observations were made on the effect of pinching on growth of superfluous shoots and suckers. The results are shown in tabular form.

"The data clearly indicate that pinching the shoots stimulates the growth of superfluous shoots and suckers. Pinching both the shoots and laterals appears to stimulate the superfluous growth less than pinching the shoots only. This is probably because the second pinching, coming later in the season than the first, and being made on a larger number of shoots, is a much more effectual check to growth than is the first pinching."

Observations were also made on the effect of pinching upon the height and stockiness of the stems and upon the labor of covering them for winter. As a result of these experiments the author is of the opinion that the importance of pinching as a means of keeping the growth of stems within bounds has probably been overestimated. In the experiments there was but little difference as regards height of canes and spread of branches between the plants pinched and those unpinched; but the labor of covering the former was fully one-third greater. The stems were decidedly more brittle and the branches were more numerous in the pinched rows.

The experiments are to be continued. The following conclusions are drawn from the data obtained up to the present time:

"In young plantations of the Gregg and Cuthbert raspberries grown under the conditions noted for these experiments, pinching the shoots high, *i. e.*, when about 24 in. tall, is beneficial to the yield, but that pinching at 12 in. high is of very doubt-

ful value, as is shown in both experiments; also, that pinching the lateral shoots is not beneficial to the yield, and that pinching increases the growth of superfluous shoots, and, in the Cuthbert variety, of suckers. Pinching also increases the cost of covering for winter protection."

Preserving fruit for exhibition, F. CRANEFIELD (*Wisconsin Sta. Rpt. 1899, pp. 309–311, figs. 2*).—Trials were made with a view to finding a method of preserving fruit for exhibition purposes that would preserve the color of the fruit as far as possible and at the same time the form. Sulphur fumes, corrosive sublimate, salicylic acid, and solutions of formalin in water were tried and found to be of little value. Mixtures of formalin and alcohol were tried, however, as preservatives for plums with considerable success. A formula containing 2 per cent of formalin, 20 per cent of alcohol, and 78 per cent of water was found to be best suited to the purpose.

"Plums put in the above mixture one year ago are at present well preserved. The fruit remains firm, and in the case of the lighter colored varieties the color is well preserved and the liquid remains clear. The color was not so well preserved in the case of the dark-purple varieties. The Japan plums are especially well preserved both in color and form. . . . Plums that were put in the mixture slightly immature cracked badly in every case, while those put in fully ripe remained without cracking. Currants, raspberries, and blackberries placed in the formalin and alcohol mixture mentioned above remained firm, but the color was not well preserved."

Rose growing with chemical fertilizers, W. STUART (*Indiana Sta. Rpt. 1899, pp. 10–35, pls. 4*).—Extensive pot experiments covering a period of 3 years were made in fertilizing Kaiserin Augusta Victoria and Perle des Jardins roses with dissolved boneblack, rock phosphate, raw bone meal, acidulated ground bone, superphosphate, nitrate of soda, and muriate of potash, for the purpose of studying the relative effects of different forms of phosphoric acid alone and conjointly with nitrate of soda and muriate of potash, on growing roses. A clayey soil was generally employed. In some instances black loam was used for comparison. The detailed results obtained with the different fertilizers and soils are reported exhaustively in a series of 20 tables. The author summarizes his conclusions as regards the results obtained as follows:

"There is every reason to believe from the results obtained in the several experiments, that chemical fertilizers when properly used may be made to serve every need of the rose plant so far as food is concerned.

"The use of raw bone meal in every instance gave an increased yield over that of the control plants, as well as giving a greater percentage of gain than did those receiving other forms of phosphoric acid.

"Pure bone meal is not injurious to rose plants, even when applied in amounts largely in excess of the requirements of the plant.

"The acidulated bone meal, which has been used by florists and supposed to be harmful, did not produce any noticeable injury, even when used in large amounts.

"As a rule, a combination of phosphoric acid and nitrate of soda gave better results than one of phosphoric acid and muriate of potash.

"Two or three applications of potash during the season was found to be preferable to a single application, although in some instances no injury from the single application was apparent.

"A larger number of Perle roses were produced from plants grown in a black than in a clay loam, while the Kaiserin gave reverse results.

"The subwatering method proved an efficient means of supplying the plants with moisture."

Rose thrips were controlled in these experiments by frequent spraying with a solution of Rose Leaf Extract of Tobacco, 1 part of the extract to 75 parts of water.

Our gardens, S. R. Hole (*London: J. M. Dent & Co., 1899, pp. 304, pls. 8*).—Deals with the history and development of English gardens, the formation of a garden, its constituent parts, herbaceous borders, and containing chapters on each of the subjects, rose, rock, water, wild, cottage, children's, town, and other gardens. Suitable plants are suggested in each instance and their characters given.

Variations produced by grafting, and their inheritance (*Gard. Chron., 27 (1900), Nos. 680, pp. 12, 13; 682, pp. 35, 36; 685, pp. 85, 86; 687, p. 116*).—Showing variations in growth, form, flowering, and chemical constitution. The article is based on work by L. Daniel (E. S. R., 11, p. 343).

Preservation of fruits, vegetables, seeds, and bulbs, H. Coupin (*La conservation des fruits des légumes, des graines, et des racines bulbeuses. Paris: Octave Doin, 1899, pp. 172, figs. 6*).—A chapter is devoted to each of the above subjects, and the material in each chapter arranged alphabetically. With the fruits and vegetables most attention is given to their preservation in the fresh and in the dried state. Under seeds, duration of vitality and preservation against insect enemies are considered. The chapter on bulbs gives directions for keeping a number of flowering sorts.

Experiments in forcing vegetables, J. Troop (*Indiana Sta. Rpt. 1899, pp. 82, 83*).—These consisted of subwatering v. surface-watering experiments with tomatoes and lettuce, and of fertilizing experiments with lettuce and peas. The results of the tests are given but no conclusions are drawn.

The new asparagus culture, G. M. Hay (*Amer. Gard., 21 (1900), No. 282, p. 344*).—The details of growing asparagus from seed suitable for cutting 2 years from date of sowing are given.

An experiment in pruning old trees, H. A. Aldrich (*Trans. Illinois State Hort. Soc., 1899, pp. 48–54*).—Old trees which had been subject to nonbearing for years were given over to thorough pruning, the whole top being headed in from 1 to 3 ft. A yield of 20 to 30 bu. of apples per tree was obtained the first season, besides a good growth of new wood.

Seaweed for fruit trees (*Agr. Jour. Cape Good Hope, 16 (1900), No. 4, pp. 231, 232*).—A brief note on the successful use of seaweed as a fertilizer and as a mulch for fruit trees.

New varieties of fruit not yet generally introduced, S. A. Beach (*Proc. West. New York Hort. Soc., 1900, pp. 34–41*). Notes on the quality and character of 12 varieties of apples, 2 of Japanese plums, 2 of grapes, and 2 of Domestica plums, as yet little grown.

Note on the cider fruits of Germany—apples and pears, A. Truelle (*Note sur les fruits de pression Allemand—pommes et poires. Rennes: V. L. Caillot, 1899, pp. 44*).—The varieties of apples and pears most used for cider in Germany are described and tables given showing their composition.

Russian apples in Indiana, J. Troop (*Indiana Sta. Rpt. 1899, pp. 78–81*).—Notes on 43 varieties of Russian apples which fruited at the station during the season. "Not one variety in the whole list can be classed as a winter apple in Indiana."

Investigations made by the State Board of Horticulture of the California olive industry (*Sacramento, 1900, pp. 83, figs. 39*).—The history of olive growing in California, methods of propagation, soils, causes of unfruitfulness, pruning, grafting, budding, varieties, methods of extracting the oil, packing, apparatus, pickling, processing, grading, and pests affecting olives are popularly considered. The work is based wholly on California conditions, methods, and practices.

Culture of the olive, N. Minangoin (*Bul. Dir. Agr. et Com., 5 (1900), No. 15, pp. 46–63*).—Systems and methods of culture of the olive employed in Tunis.

The Russian olive, C. S. Harrison (*Amer. Gard., 21 (1900), No. 286, p. 405, fig. 1*).—History and description of this ornamental tree in Nebraska.

The peach, C. Trébignard (*Rev. Hort. et Vit., 32 (1900), No. 6, pp. 110–118, figs. 2*).—Types of fruit branches and pruning are considered.

The service tree and its fruits, A. Truelle (*Du sorbus domestica et de ses fruits. Alençon: E. Renault de Broise, 1898, pp. 23*).—This discusses the varieties and uses of this fruit in the different countries of Europe and gives directions for its propagation and culture.

Culture of tree and bush fruits, A. Du Breuil (*Culture des arbres et arbrisseaux á fruits de table. Paris: G. Masson, pp. 693, figs. 55*).—In the general part of this work all the operations of the orchard are considered. The special part takes up all the more important orchard fruits, including citrus fruits, figs, apples, pears, cherries, and the like, table grapes, nuts, etc., and gives complete cultural directions for each.

Analysis of prickly pear, C. F. Juritz (*Rpt. Senior Analyst, Cape Good Hope, 1898, pp. 63–66*).—The composition of the young and older leaves, stalk, and inner portion of the stalk of the prickly pear is reported.

The culture of coffee (*Bol. Agr. Min. é Ind. [México], 9 (1899), No. 3, pp. 4–172, figs. 23*).—A comprehensive article on the history, botany, chemistry, culture, and manufacture of coffee.

The establishment of a coffee plantation, F. W. Morren (*Beihefte Tropenpflanzer, 1 (1900), Nos. 2, pp. 39–71, figs. 8; 3, pp. 75–118, figs. 6*).—Directions for preparing the land, planting, manuring, cultivating, and pruning the trees, and harvesting the crop, with notes on injurious insects and diseases affecting the trees.

Present status of coffee culture in Brazil, F. W. Dafert (*Ueber die gegenwärtige Lage des Kaffeebaus in Brasilien. Amsterdam: J. H. de Bussy, 1898, pp. 63, charts 4*).

A cocoanut analysis, F. Bachofen (*Queensland Agr. Jour., 6 (1900), No. 4, p. 297*).—The draft of the cocoanut on the soil is shown by the ash analyses reported of the husk, shell, kernel, and milk of the fruit.

Manual of practical viticulture, E. Durand (*Manuel de viticulture pratique. Paris: J. B. Baillière & Sons, 1900, pp. 424, figs. 147*).—Chapters are given on the organography and physiology of the vine, biological cycle, climate and soils, propagation, cultivation, pruning, training, manuring, pests, and like subjects, making the work a very complete treatise on practical viticulture.

Some hints on ornamental planting, C. B. Waldron (*North Dakota Sta. Bul. 41, pp. 471–491, figs. 3*).—Popular suggestions to the farmers of the Northwest on the planting of ornamental and economic trees and shrubs, with notes on some of the more essential principles of landscape gardening. There is appended a paper on "Locating shrubs for effect," by F. H. Nutter, and a table of hardiness of deciduous trees and ornamental shrubs and vines taken from Minnesota Station Bul. 24 (E. S. R., 4, p. 653).

DISEASES OF PLANTS.

Notes on various plant diseases, F. C. Stewart (*New York State Sta. Bul. 164, pp. 207–221, pls. 4*).—Notes are given on a bacterial rot of onions, powdery mildew on field-grown cucumbers, dodder on cucumbers under glass, on the possible cause of the Baldwin fruit spot,

a fusarium leaf spot of carnations, and *Chætomium contortum* on barley seedlings.

In the summer of 1898 it was reported to the station that in the onion region of Orange County, N. Y., the bulbs were rotting badly, and upon investigation it was found that in nearly all the fields there was a considerable amount of rot. Two forms were recognized, one which starts at the bottom of the onion and the second which starts at the top or neck. The latter kind was much more common and constituted probably 80 per cent of the total amount of rot. Upon cutting open the affected bulbs, it was generally found that 2 or 3 of the outer scales were perfectly sound, while the remainder of the bulb was a rotten mass. Microscopic examinations of the rotten tissues showed the absence of fungi, but there were swarms of a medium-sized motile bacillus which doubtless causes the rot. Bulbs so affected showed in addition a growth of fusarium, which aids materially in destroying the onions, and in some cases this may be the primary cause. As yet no attempt has been made to determine the identity of the organism causing the disease. Experiments were conducted in the laboratory which showed the necessity of an abundant water supply for the production of the disease, and as the onion fields had been frequently inundated on account of the heavy rainfall during the season, the conditions were favorable for the presence and rapid spread of the disease.

The powdery mildew on field-grown cucumbers is reported by the station, although the identity of the fungus is a matter of some conjecture. While powdery mildew has been known to occur on cucumbers grown under glass, this is probably the first report of its occurrence in the field. There seems to be little likelihood of its becoming epidemic, and should it do so, it probably would not be difficult to control.

The author reports the occurrence of dodder, probably *Cuscuta gronovii*, on cucumber plants grown in the station hothouse.

Investigations were conducted to determine whether the Baldwin fruit spot is caused by fungi or bacteria. This disease, which is quite characteristic on the Baldwin apple, occurs in the form of conspicuous spots on the surface of the fruit. The spots vary in color from light to dark brown, are generally circular in outline, although sometimes quite irregular, but always with the corners well rounded and sharply delimited from healthy tissue. Underneath the surface spots the tissue is light brown, dry, and spongy for a distance of $\frac{1}{8}$ to $\frac{3}{16}$ in. This spongy tissue is not bitter to the taste, or at least but slightly so. Microscopic examination of the tissue revealed no fungi or bacteria which could be definitely demonstrated. From the results of the author's study, he concludes that this form of apple fruit spot is not caused by fungi or bacteria and that the real cause is unknown.

A report is given of a fusarium occurring on the carnation, resulting in leaf spot. The plants had been growing under conditions espe-

cially favorable to fungi, being situated so that the direct sunlight never reached them. The spots varied in length from $\frac{1}{8}$ to 1 in. and were covered by a pinkish-gray mold dotted in the center with yellow spore masses of the fusarium. The fungus was evidently parasitic on the leaves, but careful examination revealed the fact that in every case the spots originated in a rust sorus. It appeared that the fungus was unable to attack the uninjured leaf, but when the epidermis was broken by rust, it was able to enter and bring about the decay. Inoculation experiments, it is thought, will show that this fungus is identical with that causing carnation stem rot.

A report is given of the occurrence on barley seedlings of the perithecia of *Chætomium contortum*. This fungus was previously noted as occurring on lily bulbs in a greenhouse on Long Island, where it was discovered by the author in 1895. No report had been made of the occurrence of this fungus from that time until the present, when it was found on barley. The indications are that it is not parasitic, but that the spores had become attached to the barley seeds before they were planted.

Corn smut, J. C. ARTHUR and W. STUART (*Indiana Sta. Rpt. 1899, pp. 84–135, pls. 4, chart 1*).—A detailed report is given on corn smut, the investigations of the authors and others being drawn upon. Corn-smut experiments have been conducted at the station for about 10 years, in which the life history of the fungus has been studied, together with possibilities of discovering methods for prevention. An historical résumé is given of the experiments with corn smut, the proper scientific name of which the author claims is *Ustilago zeæ*. The life history of the fungus, as shown by the development of the spores, etc., is described at considerable length. The influence of weather and maturity on infection, the distribution of the smut pustules over the plant, and prevention by spraying are discussed at some length. Details of some of these investigations have been previously reported (E. S. R., 8, p. 317).

Experiments in which corn plants were sprayed with Bordeaux mixture and other fungicides showed that the disease can be controlled, but the economic consideration places such treatment out of the possibility of utilization. It is recommended that all smut masses be destroyed by burning or putting in boiling water. The effect of smut on animals, as shown by a careful review of literature, is given, together with notes on the digestibility of the smut fungus. A summary is given by the authors of their investigations, and an extensive bibliography on the subject completes the report.

Club root, W. HAWK (*Rpt. Agr. Expts. Cornwall County Council 1898, pp. 27–42, pls. 7*).—Experiments in the treatment of club root of turnips are reported. Lime was applied in different quantities at various depths and at different seasons. A plat of land receiving 6

tons of lime per acre and frequently cultivated to a depth of about 3 in. yielded, with a basic slag fertilizer, 18 tons, 952 lbs. of roots per acre, and with superphosphate, 11 tons, 308 lbs. of roots per acre. On the basic slag the number of sound roots per pole was 156, and of diseased roots, 126. On the superphosphate the number of sound roots was 54, and of diseased roots 132.

Another plat similarly treated in all respects, with the single exception that it was cultivated only occasionally and then to the depth of only ½ in., yielded, with slag, 13 tons, 644 lbs. of roots per acre, and with superphosphate, 9 tons, 1,904 lbs. On the slag in this case the number of sound roots per pole was 102 and the number of diseased roots 186. On the superphosphate there were only 60 sound roots per pole, but 144 diseased roots. "It will be seen that both on the slag and superphosphate halves of the plats the figures are conclusively favorable to the thorough incorporation of the lime with the soil."

In studying the quantity of lime that should be applied, the plats just referred to, receiving 6 tons of lime per acre, were compared with similar plats receiving 8 tons per acre. The turnips on slag receiving 6 tons of lime per acre yielded 18 tons, 952 lbs. of roots per acre, while the plat treated with 8 tons of lime produced only 18 tons; but on the plat receiving 8 tons of lime, more than 5 out of every 6 roots were sound, while on the other plat nearly one-half of the roots were more or less diseased. The figures for the plats receiving superphosphate were very different, but the general results were the same. The yields of turnips on the plats receiving basic slag and those receiving superphosphate, as reported in the first experiment above, are, as already indicated, highly favorable to slag; but when the lime was applied in June instead of in the autumn, as in that case, the amount of yield on the respective plats was reversed, but was in each case much less than when lime was applied in the fall.

Tests of kainit and sulphate of iron showed that both were equally powerless to check the disease. Sulphate of copper checked the disease to a small extent. Experiments are now in progress to determine whether the micro-organism causing the disease can survive passage through an animal.

Apple-tree anthracnose, A. B. CORDLEY (*Oregon Sta. Bul. 60, pp. 8, pls. 3.*)—For several years there has been known in the apple orchards of western Oregon, Washington, and British Columbia a more or less serious disease which is locally known as canker, dead spot, or black spot. Investigations on the part of the author have led him to the conclusion that this is an undescribed disease caused by a species of Glœosporium, to which the name *G. malicorticis* has been given. In order to avoid confusion, he proposes for this disease the common name apple-tree anthracnose.

The disease principally attacks the smaller branches, although occurring sometimes on the larger ones and often on the trunks of young trees. It appears in the fall, soon after the autumn rains begin, as small, irregular, slightly depressed brown areas of the bark. During the fall and winter its spread is very slow, but with the recurrence of spring it spreads rapidly, until an area of several inches in diameter is infected. Occasionally a single area completely girdles a branch, killing at once its distal portion, but more commonly a dead spot occurs, from which, in the course of a few months, the bark sloughs off, leaving an ugly wound, which heals very slowly. The cause of the disease is mentioned and the fungus briefly characterized. The fungus has been isolated and grown on various cultures and inoculation experiments successfully made.

As possible remedies, the author suggests the use of Bordeaux mixture or ammoniacal copper carbonate, together with pruning of badly infested trees.

The New York apple-tree canker, W. PADDOCK (*New York State Sta. Bul. 163, pp. 179–206, pls. 6*).—In 1898 the station authorities were requested to investigate the cause of the dying of trees in an orchard in East Bloomfield, N. Y. The orchard in question originally consisted of 125 acres. The trees on 30 of the 80 acres in one part were ruined by the canker and had been taken out, and one-half of the trees on the remaining 50 acres are now of little value.

The owners have noticed the disease for at least 6 or 8 years, but it has increased rapidly only in the last 3 or 4 years. It showed a decided preference for certain varieties, the Twenty Ounce being the most susceptible, followed by Baldwin, Wagener, Greening, and King, in the order named. Tallman Sweet appears to be practically free from the disease.

Investigations as to the possible cause of the disease resulted in the discovery that it was due to the same cause as the black rot of the apple (*Sphæropsis malorum*). More than 50 successful inoculations were made in 1898, and in 1899 the experiments were repeated many times with the same result.

The geographical distribution of the fungus, as determined from circular letters sent to various stations, is as follows: Connecticut, Indiana, Maryland, Michigan, Pennsylvania, and Vermont, and probably in Illinois, Maine, Massachusetts, Minnesota, New Jersey, West Virginia, and portions of Canada.

The author thinks it probable that when the disease becomes more generally known it will be found in many of the apple-growing sections of the Northern, Central, and New England States.

The appearance of the disease may be recognized by the occurrence of dark enlarged sections on the larger limbs which, upon closer exami-

nation, show a much roughened and thickened bark, and in many instances a portion of the wood is laid bare. The dead bark on many diseased limbs clings tenaciously to the decaying wood, which is a feature that distinguishes this canker from sun scald. The area of bare wood is often small as compared with the extent of swollen bark. The progress of the disease is marked by numerous pits and scars, showing where the fungus was able to live until it gained entrance to the cambium through some injury. The scars are usually circular in form and may be outlined by 2 or more concentric lines. The fungus shows a preference for the larger limbs of mature trees, although the trunks and branches of young trees, as well as the small limbs and twigs of a current season's growth, suffer from its attack. While the extent of injury done to the orchards can scarcely be estimated, it is the author's belief that it is one of the worst diseases which the orchardist will have to contend with, since it attacks the tree directly instead of the foliage.

Infection, it is stated, takes place in the spring of the year, and the presence of the fungus is indicated in a newly-infected limb by the appearance of a small area of discolored bark. This area extends slowly as the fungus grows outward until midsummer, when a definite boundary forms between the dead and living bark. The season's growth is stopped by the 1st of August, and in some instances pycnidia containing mature spores were found at that time. The mycelium was unable to penetrate to the cambium through the living bark, but those spores which chanced to fall and germinate in a wound produced the cankers. There is some evidence that the mycelium lives over winter and continues its growth the following spring.

Among preventive measures, the author recommends that special attention should be paid to the sanitary condition of the trees. The practice of scraping and whitewashing the trunks, now largely in disfavor, is recommended for adoption in localities where canker is severe; also washing the trees with a whale-oil soap mixture, spraying with Bordeaux mixture, cutting out cankered limbs, and covering the wounds with Bordeaux mixture or some other fungicide. The time for spraying is given, the first application to be made at the time that the leaf buds begin to open, a second a week before the blossom buds open, a third as soon as all the blossoms have fallen, and a fourth 10 days or 2 weeks later.

The investigations of this disease were continued in 1899, and it was found that a number of fruit trees are attacked by species of Sphaeropsis. The author's investigation would seem to indicate that the number of species can be materially reduced, since there is great probability of the same species occurring in a slightly modified form upon a number of hosts.

In 1898, while preliminary studies in apple canker were being conducted, a body blight of pear trees was discovered in which a Sphæropsis was found abundant, commonly associated with *Macrophoma malorum*.

Notes are given on a Pacific-coast apple-tree anthracnose, which is described elsewhere (E. S. R., 12, p. 58), and a European canker due to species of Nectria.

Plant diseases, A. L. QUAINTANCE (*Georgia Sta. Rpt. 1899, pp. 139–141*).—Brief notes are given on the occurrence of a number of diseases, with suggestions for their prevention. Among those enumerated are the Macrosporium disease of tomato plants and eggplants, Sclerotium disease of Irish potatoes and tomatoes, a rot of tomatoes, the black rot of grapes, the brown rot of grapes, celery blight, and soft rot of sweet potatoes.

Divers diseases discussed, F. H. HALL (*New York State Sta. Bul. 164, popular ed., pp. 5*) —A popular edition of Bulletin 164 of this station, in which a number of plant diseases are discussed (see p. 55).

Report of the botanist, C. E. BESSEY (*Rpt. Nebraska State Bd. Agr. 1898, pp. 139–161*).—A preliminary account of the diseases of the farm crops of Nebraska.

The diseases of the potato, E. GAIN (*Sta. Agron. Nancy Bul. 1, 1899, pp. 40–51*).—The author divides the diseases of the potato into 2 categories based upon their importance. In the first are placed the dry rot, wet rot, Phytophthora, and a spot disease called frizolée. In the second class are considered potato scab, Rhizoctonia, a disease due to *Spongospora solani*, and the greening of the tubers. The causes of these various diseases are described, together with their effects upon the host plants, and suggestions are given wherever known for the prevention of the diseases.

Smut in wheat (*Agr. Jour. Cape Good Hope, 16 (1900), No. 3, pp. 147–152*).

Gumming disease in cane (*Internat. Sugar Jour., 2 (1900), No. 14, pp. 97, 98*).

Asparagus rust, P. H. ROLFS (*South Carolina Sta. Rpt. 1899, p. 17*).—Asparagus seed from a field of rusted asparagus carried many spores, although the berries did not appear to be diseased. "Though direct evidence is wanting, it seems altogether probable that seedlings raised from such seeds would contract the disease." Uredo spores were found on stocks of two-year-old plants in a diseased field two or three inches below the surface of the ground. In such cases burning over the beds, which has sometimes been recommended, would not eradicate the disease. It is not considered advisable to plant seed gathered from a rusted field, nor to set out a plantation with plants from such a source.

Fruit tree enemies, E. H. POTTER (*Gard. Chron., 3. ser., 27 (1900), No. 681, p. 20*).—Notes are given on canker, mildew, gumming, and numerous insect enemies, with suggestions for their suppression.

Canker—an enemy of the apple, F. H. HALL and W. PADDOCK (*New York State Sta. Bul. 163, popular ed., pp. 6, pls. 2*).—A popular edition of Bulletin 163 of the station (see p. 59).

Diseases of the olive, L. NAVARRO (*Bol. Agr. Min. é Ind. [México], 9 (1899), No. 2, pp. 3–115, pls. 12*).—This article is in the nature of a general treatise on olive diseases. The diseases of the olive are considered under the following five heads: Influences of the soil, influences of the atmosphere, diseases caused by vegetable parasites, injuries caused by insects, and diseases produced by faulty systems of cultivation.

Fumagine and its treatment, L. DEGRULLY (*Prog. Agr. et Vit. (Éd. L'Est), 21 (1900), No. 6, pp. 165, 168*).—Notes are given on fumagine, or sooty mold, occurring on the foliage of the grapes. As the fungus follows attacks of plant lice, the use of

insecticides is advised, the petroleum soap or similar mixtures being recommended. Another formula highly commended is water 100 liters, quicklime 20 kg., and heavy coal oil 8 kg. Winter washes are also advised.

Fungi occurring in the greenhouses of the Berlin Botanic Gardens, P. HENNINGS (*Verhandl. Bot. Ver. Brandenburg, 40* (*1898*), *p. 109; abs. in Centbl. Bakt. u. Par., 2. Abt., 5* (*1899*), *No. 20, pp. 687–689*).—An extensive list of fungi and their host plants is given.

The nematode and ammonia salts, C. SCHREIBER (*Rev. Gén. Agron. Louvain, 9* (*1900*), *No. 3, pp. 97–102*).—This is an account of experiments during 1897, 1898, and 1899 on the use of ammonia salts to destroy nematodes in the soil. Ammonium chlorid and nitrate proved effective for this purpose.

Notes on Bordeaux mixture (*Wiener Illus. Gart. Ztg., 24* (*1900*), *No. 1, pp. 13–15*).

Potassium permanganate as a fungicide, A. CHEVALLIER (*Prog. Agr. et Vit.* (*Éd. L'Est.*), *21* (*1900*), *No. 4, pp. 113, 114*).—Potassium permanganate 100 gm., soap 200, and water 100 liters, is said to make a convenient and efficient fungicide for combating black rot and grape mildew.

On the use of calcium carbid as a fungicide, F. GALLET (*Prog. Agr. et Vit.* (*Éd. L'Est.*), *21* (*1900*), *No. 4, pp. 126, 127*).—Notes the successful use of this substance for the prevention of oidium.

ENTOMOLOGY.

Insect notes for 1899, A. L. QUAINTANCE (*Georgia Sta. Rpt. 1899, pp. 141–145*).—Some experiments were conducted in the destruction of *Aphis mali*. A 10 per cent mechanical mixture of kerosene and water killed 50 per cent and a 15 per cent mixture killed 90 per cent of the insects without injury to the trees, while a 20 per cent mechanical mixture killed 92 per cent of the insects, but killed the tree.

Rose Leaf, 1 part to 48 parts of water, killed 98 per cent of the insects. Nikoteen in the same proportion killed from 99 to 100 per cent of the insects, while whale-oil soap, 1 lb. to 6 gal. of water, killed 96 per cent of the insects. These 3 remedies caused no injuries to the trees. Rose Leaf proved almost as effective as Nikoteen, and is much cheaper.

The harlequin cabbage bug (*Murgantia histrionica*) was unusually abundant during the year. A 10 per cent mechanical mixture of kerosene and water killed about 15 per cent of this insect, a 15 per cent mixture killed from 35 to 40 per cent, while a 20 per cent mixture killed about 85 per cent of the bugs, but the latter mixture injured the plants considerably. Nikoteen, 1 part to 32 parts of water, killed about 45 per cent of the insects, and Rose Leaf, 1 part to 32 parts of water, killed none of the insects, although it seemed to act as a repellent.

The author states that despite the severity of the winter of 1898–99, injurious insects caused more than the usual amount of damage throughout the State during the year.

The latter part of the report is a reprint of an article already noted (E. S. R., 11, p. 952).

The peach-tree borer, M. V. SLINGERLAND (*New York Cornell Sta. Bul. 176, pp. 155–233, figs. 16; abridged ed., pp. 16, figs. 12*).—The chief purpose of this bulletin is to present the results of an extended series of experiments with various remedies for the destruction of the peach-tree borer. Besides the discussion of remedies, however, the author presents an account of the habits and life history of the insect, so that the bulletin is considered a sort of compendium of knowledge concerning the peach-tree borer.

The insect lives only a short time in the adult stage and the larvæ are not known to leave the peach tree during their development. The distribution of this insect is, therefore, brought about for the most part by means of infested nursery stock. The author describes the appearance of infested trees, with an account of the gummy exudations.

The insect is probably single brooded everywhere in the United States. In New York the moths appear from June until September. The eggs are laid within a few hours after emerging, on the trunks of trees from 6 to 18 in. from the ground. They hatch in about a week and the young larvæ immediately make their way into the bark. At the beginning of winter the larva prepares for hibernation, either in its burrow or in a thin case on the surface of the bark near the soil. The larvæ begin spring feeding about May 1, and most of them become full grown by June. The author presents an account of the natural enemies of the peach borer, of which one species (*Ephialtes irritator*) was bred by him for the first time.

The author's experiments with remedies against the peach borer extended over a period of about 4 years. An orchard of nearly 400 peach trees of 5 varieties was planted near the insectary for experimental purposes. The author considers the following substances injurious to the trees, and therefore dangerous: Paris green and glue, Raupenleim, Dendrolene, white paint, white paint and Paris green, and printer's ink.

Among effective remedies the following are mentioned: Hale's wash (2 applications), mounding, tarred paper, tobacco stems, gas tar, and digging out. In general it may be stated that remedies against the peach borer are not very successful.

Experiments in growing tansy about peach trees showed that this plant had very slight effect in repelling the borer, but tobacco stems tied about the base of the tree had a noticeable effect. In experiments with the mounding method the soil was usually heaped up to a height of from 6 to 10 in. about the base of the trees. The results indicate that from one-half to seven-tenths of the borers were kept out by this method. In experiments with tarred paper, which was wrapped about the base of the tree, the results indicate that from one-half to seven-eighths of the borers were kept out. It is suggested that probably ordinary paper if carefully applied would prove as effective

as tarred paper. Quite extensive experiments were carried on with wire cages placed about the trees, and it was found that although this method seemed promising from a theoretical standpoint, it proved useless in its practical application. An asafœtida and aloes wash was applied to some of the trees for the purpose of determining whether offensive-smelling substances had any effect in deterring the adult insects from laying their eggs upon the trees. The results were negative. Various soap washes, whitewash, and lime-sulphur-salt wash proved to be practically ineffective, as did also hydraulic cement wash. The Paris green and glue wash killed the trees within a few weeks. With regard to the digging-out method, the author states that this is the "only thoroughly successful and safe way of killing the peach-tree borer." He recommends, however, that it be combined with one or another of the methods classified as effective, the particular combination to be made depending on the special circumstances of each case.

An extended bibliography is given of the peach-tree borer from 1749 to the present time.

Preliminary report on the insect enemies of forests in the Northwest, A. D. Hopkins (*U. S. Dept. Agr., Division of Entomology Bul. 21, n. ser., pp. 27*).—This preliminary bulletin contains a detailed itinerary of a trip by the author through the Northwest and a general account of observations made upon this trip. Especial attention was given to the study of the Scolytid enemies of forests of the Northwest. Among the trees of which the insect enemies were studied, the following may be mentioned: Redwood, western yellow pine, sugar pine, silver pine, red fir, tideland spruce, red cedar, western hemlock, lowland fir, noble fir, and western larch.

Popular notes are given on the influence of farming methods and lumbering methods upon forests and upon the relation of forest fires to depredations by insects. Brief notes are also presented upon the relation of insect enemies of trees to forest fires, the relation of the diseases of trees to insect enemies, and the interrelations of forest fires, insects, and fungus diseases.

Among forest insects of the Northwest which are considered of the greatest economic importance, the following may be mentioned: *Dendroctonus brevicornis*, *D. similis*, *Scolytus præceps*, *Melanophila drummondi*, and *Neophasia menapia*.

Paris green for the codling moth, C. W. Woodworth and G. E. Colby (*California Sta. Bul. 126, pp. 40, figs. 2*).—During the past 3 or 4 years complaints have been made of the uncertain results obtained from spraying with Paris green. A circular letter was sent to entomologists and editors of agricultural newspapers for the purpose of obtaining statistics upon the question of the quality of Paris green. The answers to this circular letter indicated that in some cases

good and rather uniform results have been obtained by the use of Paris green, while in an equally large number of cases the Paris green was found to be unreliable.

The author recognizes 3 classes of unsatisfactory Paris green—bogus, adulterated, and low grade. In bogus Paris green, substances are substituted for the copper and arsenic of the ordinary Paris green. In adulterated Paris green, white powders, such as gypsum or flour, are added to increase its weight. In the low-grade Paris green there is a low percentage of arsenious oxid in combination, and the requisite percentage of arsenic is secured by the addition of free or soluble arsenious oxid. White arsenic has long been known to be injurious to foliage. The chief feature of Paris green which has made it a standard insecticide is its insolubility, and the addition of free arsenious oxid renders the substance dangerous and worthless as an insecticide. Two forms of poisoning from this substance may be recognized—the acute and chronic. In acute poisoning the leaves show a blackening within 24 hours after the application of the insecticide. In chronic poisoning the leaves become prematurely yellow and drop off within 2 or 3 weeks after the application is made.

A sample of Paris green manufactured in New York City, upon analysis, was found to contain 23.6 per cent of its weight of free arsenious oxid which was soluble in water. Another sample sent to the station contained 29.4 per cent of soluble arsenious oxid. Such grades of Paris green must, of course, be condemned, as they would cause excessive injury to the foliage of fruit trees. A sample of barium arsenite which was analyzed at the station contained 27.64 per cent of free arsenious oxid. One sample of "pink arsenoid," or lead arsenite, contained only 3.24 per cent of free arsenious oxid, while the content of combined arsenious oxid was 40.02 per cent. This sample would not be dangerous to foliage and could be recommended. A sample of copper arsenite contained 7.82 per cent of arsenious oxid, and is, therefore, to be considered as dangerous. A sample of proprietary arsenical spray known as Paragrene was examined under the microscope. It was seen that the sample contained a considerable quantity of gypsum and also crystals of white arsenic. An analysis disclosed the fact that the sample contained 23.08 per cent of free arsenious oxid, and was, therefore, dangerous.

Considerable quantities of lime have been added to the water in which Paris green is mixed in order to render insoluble the free arsenic or other soluble arsenites which are present in Paris green. This method is unsuccessful, however, in cases where the quantity of free arsenic is large.

Several tests may be applied for the purpose of determining the purity of Paris green. Paris green dissolves freely in ammonia, while the majority of substances which have been used for adulterating

it are insoluble in ammonia. This test is valuable, but can not be depended upon in all cases. If a small quantity of the Paris green be placed upon a glass slide and the glass jarred so as to cause the Paris green to slide down the surface of the glass, a bright green track will be left behind if the sample is pure, whereas the track will be white or pale green in case it is impure. The most satisfactory test, however, is the microscopic one. Under the microscope Paris green appears in the form of clean round masses. In impure samples one readily observes in addition to these regular spheres quantities of material of irregular crystalline shape, usually of paler color.

In New York, Louisiana, Texas, and Oregon laws have been enacted requiring Paris green to contain 50 per cent of arsenious oxid. A great defect of these laws is that no attempt is made to distinguish between soluble and insoluble arsenious oxid. A very low grade of Paris green may, therefore, be made to contain a sufficient quantity of arsenic by simply adding arsenious oxid, which is cheaper than Paris green. The standard which has been adopted by the station makes the following requirements: "(1) The sample will be expected to contain, as seen under the microscope, only a trace of foreign matter; (2) the total arsenious oxid shall exceed 50 per cent; (3) the samples shall contain practically no free arsenic or other soluble arsenical compound."

Paris green has proved a satisfactory insecticide against the codling moth when a standard quality is used. The substance has, however, become so unreliable that it seems advisable in the opinion of the author to use some substitute. Arsenite of copper has been used in various localities with considerable success. Barium arsenite was found unsatisfactory, being easily soluble and injurious to the foliage. London purple is the oldest substitute for Paris green, but it often contains considerable free arsenic so as to make it injurious to the foliage. Arsenite of lime has been used in several States with good results. Arsenite and arsenate of lead have been used by the Gypsy Moth Commission as a substitute for Paris green. The arsenate of lead is decidedly the better substance for the gypsy moth and is perhaps to be preferred. Practical directions are given for preparing arsenate of lead, arsenic and lime, and arsenic, soda, and lime.

The author gives a brief discussion of various other methods for fighting the codling moth, among which mention may be made of the band treatment, the destruction of windfall apples, destruction of the codling moth in storage houses, the use of traps for the destruction of the moth, scraping the bark, and the application of winter sprays. Attention is called to the fact that one application of an insecticide is not sufficient. The spraying should be repeated during the summer at intervals of 3 or 4 weeks. It is necessary to take account of differences in the habits of the moth in different localities and during

different seasons in the same locality. The first application in most localities should be made soon after the flowering period, and an effort should be made to wet every part of the plant, since the eggs are deposited indiscriminately on the leaves or upon the young fruit.

Report of analyses of Paris green and other insecticides, L. L. Van Slyke (*New York State Sta. Bul. 165, pp. 221–232*).—On account of frequent complaints of the inefficiency of Paris green, the station undertook a chemical investigation of this and other insecticides. Tables are given showing the percentage composition of chemically pure Paris green or copper aceto-arsenite.

In 24 samples of Paris green which were analyzed, the quantity of arsenious oxid varied from 55.34 to 60.16 per cent and averaged 56.48 per cent. The amount of copper oxid in these samples varied from 27.7 to 30.9 per cent, and averaged 29.97 per cent. In pure Paris green, the ratio of arsenious oxid to copper oxid should be 1.87 : 1. In the samples of Paris green which were analyzed, this ratio varied from 1.82 to 2.17 : 1, and averaged 1.88 : 1. The ammonia test indicated the samples to be for the most part free from white arsenic. In all samples the amount of arsenious oxid exceeded the legal requirements. The only adulterant which was found was white arsenic, and this in only 2 cases.

Brief notes are given on analyses made of the following insecticides: Paragrene, Black Death, Slug Shot, London purple, Laurel Green, Smith's Electric Vermin Exterminator, and Bug Death. In the New York law regarding Paris green there is nothing to prevent the addition of any quantity of white arsenic to Paris green. This is considered a decided defect in the law, but from the samples which were analyzed it would appear that it has not been taken advantage of to any considerable extent. The text of the New York law is appended to the bulletin.

The queen bee, A. Gale (*Agr. Gaz. New South Wales, 11 (1900), Nos. 1, pp. 28–31; 2, pp. 127–130*).—Popular notes on the life history and habits of the queen bee.

Care of bees in February, L. Wolff (*Deut. Landw. Presse, 27 (1900), No. 9, p. 84*).—On account of the small honey flow during the previous season, spring feeding is recommended.

The histolysis of the adipose body in the bee, L. Terre (*Compt. Rend. Soc. Biol. Paris, 52 (1900), No. 7, pp. 160–162*).—In young larvæ of bees the adipose body consists of a number of more or less rounded cells inclosing large, clear vacuoles. The nucleus of these cells is conspicuous and sharply outlined. The histolysis of this body takes place by a sort of digestion and does not depend upon leucocyte phagocytosis.

The principal household insects of the United States, L. O. Howard, C. L. Marlatt, and F. H. Chittenden (*U. S. Dept. Agr., Division of Entomology Bul. 4, n. s., rev. ed., pp. 131, figs. 64*).—This is a reprint of Bulletin 4 of this Division with slight changes (E. S. R., 9, pp. 62–66).

Notes on the part played by insects as carriers of infection, P. Sonsino (*British Med. Jour., 1900, No. 2041, pp. 328, 329*).—This paper reports a study on the

life history of *Filaria bancrofti* in the body of the mosquito. The Filaria was found infesting *Culex pipiens* and *C. ciliaris*.

A novel trap for cockroaches (*Sci. Amer. Sup., 49 (1900), No. 1255, p. 20125, figs. 3; from La Nature*).—A description of a box trap which is said to catch both young and adult cockroaches.

How to distinguish the different mosquitoes of North America, L. O. HOWARD and D. W. COQUILLETT (*U. S. Dept. Agr., Division of Entomology Circ. 40, 2. ser., pp. 7, figs. 3*).—A synoptic table for the identification of North American species of Anopheles, Culex, Psorophora, Megarhinus, and Aedes.

Insect bites and the effects thereof, C. P. LOUNSBURY (*Canad. Ent., 32 (1900), No. 1, pp. 17–24*).—The author discusses at some length the reported cases of injurious effects from the bite of *Argas persicus*. The author believes that *A. persicus*, *A. columbæ*, *A. americanus*, and *A. reflexus* probably represent only 1 species. The bite of this tick can hardly be dangerous except under peculiar conditions, but there is always the possibility of the transmission of contagious disease.

Notes are given on bites caused by *Onithodoros savignyi*.

Apple insects of Maine, F. L. HARVEY and W. M. MUNSON (*Maine Sta. Bul. 56, pp. 105–144, pls. 8*).—This bulletin contains a description and an account of the life history, the vulnerable points, and remedies for the following insects which are injurious to the apple: *Anisopteryx pometaria*, *Aphis mali*, *Bucculatrix pomifoliella*, *Cacœcia rosana*, *Carpocapsa pomonella*, *Chrysobothris femorata*, *Clisiocampa americana*, *C. disstria*, *Conotrachelus nenuphar*, *Hyphantria cunea*, *Hybernia tillaria*, *Mytilaspis pomorum*, *Œdemasia concinna*, *Platysamia cecropia*, *Saperda candida*, *Schizoneura lanigera*, *Teras minuta*, *Tmetocera ocellana*, *Trypeta pomonella*, *Xyleborus pyri*, and *Notolophus leucostigma*.

Reports on injurious insects in Finland—I-IV, E. REUTER (*Helsingfors, 1895–1899*).

Some common Florida scales, H. A. GOSSARD (*Florida Sta. Bul. 51, pp. 105–128, figs. 8*).—This bulletin contains notes on the appearance, habits, life history, natural enemies, artificial remedies, and host plants of the following insects: *Mytilaspis citricola*, *M. gloverii*, *Lecanium hesperidum*, *L. oleæ*, *L. hemisphæricum*, *Ceroplastes floridensis*, *C. cirripediformis*, and *Dactylopius citri*.

General observations are made on the advisability of spraying at the proper time and in the proper manner. Brief notes are given on the use of kerosene, resin wash, and whale-oil soap.

Notes on Australian Coccidæ, W. W. FROGGATT (*Agr. Gaz. New South Wales, 11 (1900), No. 2, pp. 99–107, pl. 1*).—Notes on the life history and economic relationship of the following species of the genus Eriococcus: *E. araucariæ*, *E. araucariæ* var. *minor*, *E. capitata*, *E. buxi*, *E. conspersus*, *E. coriaceus*, *E. confusus*, *E. eucalypti*, *E. leptospermi*, *E. multispinosus*, *E. paradoxus*, *E. spiniger*, *E. tepperi*, and *E. turgipes*.

Inspection of American fruit for San José scale in Hamburg, J. KOCHS (*Deut. Landw. Presse, 27 (1900), No. 9, p. 84, figs. 2*).—Brief popular notes.

Truth about the San José scale, J. P. SMITH (*Amer. Agr., 65 (1900), No. 1, pp. 2, 8*).—Popular notes on the efficiency of various remedies against this insect.

German echoes of the commercial inspection (*Sci. Amer. Sup., 49 (1900), No. 1259, pp. 20189, 20190*).—Brief notes on the dangers from San José scale in Germany.

The codling moth (*Jour. Agr. and Ind. South Australia, 3 (1900), No. 6, pp. 507–509*).—Report of a special committee concerning the extent of infestation of South Australia by the codling moth and means for its eradication.

The strawberry sawfly and the gooseberry fruit worm, J. P. CHAPAIS (*Nat. Canad., 27 (1900), No. 2, pp. 17–20*).—Brief notes on *Emphytus maculatus* and *Dakruma convolutella*.

Fruit fly notes, C. P. Lounsbury (*Agr. Jour. Cape Good Hope, 16 (1900), No. 1, pp. 43–45*).—Experiments by the author indicate that the insect probably does not hibernate in the adult stage, but as pupæ. The remedies recommended are the destruction of infested windfalls, covering the trees with nets, and allowing fowls to run in the orchard.

Notes on some micro-lepidoptera, Schütze (*Stettin. Ent. Ztg., 60 (1899), No. 7–8, pp. 163–179*).—Notes on a species of Tinea, Prays, Argyresthia, Galechia, and Brachmia.

On Ægaleus bechuana, a new species of Cimicidæ reported to injure coffee berries in British Central Africa, G. W. Kirkaldy (*Entomologist, 33 (1900), No. 442, pp. 77, 78*).—Specimens of this insect were sent to the author from Central Africa by Mr. Green with the statement that they were puncturing coffee berries. The species is described as new.

Fruit-feeding habit of the cotton worm moth, C. E. Brown (*Bul. Wisconsin Nat. Hist. Soc., n. ser., 1 (1900), No 1, pp. 67*).—*Aletia argillacea* is reported as feeding upon grapes in Milwaukee.

Caterpillars and maple sugar (*Nat. Canad., 27 (1900), No. 2, pp. 26–28*).—A brief account of the effects of depredation by *Clisiocampa disstria* upon the quality of maple sugar.

A gall-making Coleophora, Walsingham (*Ent. Mo. Mag., 2. ser., 11 (1900), No. 123, pp. 59, 60*).—*C. stefanii* is reported as producing galls on the stems of *Atriplex halimus*. The author gives brief notes on the appearance and habits of this insect.

Swarming of the milkweed butterfly (Danais archippus), P. H. Dernehl (*Bul. Wisconsin Nat. Hist. Soc., n. ser., 1 (1900), No. 1, pp. 64, 65*).

Gadfly and botfly, C. J. Valentine (*Jour Agr. and Ind. South Australia, 3 (1900), No. 6, pp. 516, 517*).—Notes on the life history of *Gastrophilus equi*.

The breathing of Hydrophilus, H. J. Kolbe (*Illus. Ztschr. Ent., 5 (1900), No. 3, pp. 38, 39*).—The author's observations were made on *Hydrophilus piceus*. The beetles were observed to come frequently to the surface of the water to obtain air.

Lethrus apterus, J. Tarnani (*Illus. Ztschr. Ent., 5 (1900), No. 4, pp. 49, 50*).—Brief notes on the habits, life history, and food plants of this insect, which is especially injurious to grape vines.

On the larvæ, habits, and structure of Lithocolletis concomitella and its nearest allies, J. H. Wood (*Ent. Mo. Mag., 2. ser., 11 (1900), No. 122, pp. 30–34*).—A description of the larvæ, with notes on the mining habits of this and other species in the leaves of *Prunus avium, Pyrus aucuparia*, etc.

FOODS—ANIMAL PRODUCTION.

Cereal breakfast foods, C. D. Woods and L. H. Merrill (*Maine Sta. Bul. 55, pp. 93–106*).—The authors report the analysis of a considerable number of commercial cereal breakfast foods. These include 4 corn preparations, 3 uncooked oatmeals, 11 cooked oat preparations, 16 wheat preparations, 3 gluten preparations, and 4 miscellaneous articles.

The different articles and classes are discussed at some length. The authors note that many of these cereal foods have been thoroughly cooked during the process of manufacture and then dried, so they will keep indefinitely.

"The process of manufacture is hygienic and cleanly and will bear the closest inspection. Starting from the elevator, the goods are cleaned, milled, cooked, evaporated, and packed by machinery. It is very gratifying to find that this class of goods is free from adulteration and careless preparation. . . .

"Protein is furnished more cheaply by oat preparations than by those of corn or wheat. The oats also supply fat 10 times as cheaply as the corn products and 5 times as cheaply as the wheat foods. The carbohydrates are supplied most economically by the corn preparations, oats ranking second. In fuel value, oats again rank first.

"If wheat flour be included in the comparison, it will be found to be the cheapest source of protein and carbohydrates. With the exception of one sample of rolled oats, it also leads in fuel value."

Commercial feeding stuffs in the Connecticut market, E. H. JENKINS, A. L. WINTON, ET AL. (*Connecticut State Sta. Bul. 130, pp. 40*). Commercial feeding stuffs and their uses are briefly discussed, and the analyses of a large number of such materials reported. These were made in compliance with the Connecticut law regulating the sale of these goods and include cotton-seed meal, linseed meal, ground wheat, bran, middlings, mixed wheat feed, corn meal, gluten meal and gluten feeds, hominy chop, ground oats, provender, corn and oat feeds, oat feeds, corn, oats, and barley, rye bran and rye feed, malt hulls, starch feeds, Champion Bell Fodder, H. O. dairy feed, H. O. horse feed, H. O. poultry feed, American Cereal Company's Quaker Dairy Feed and Poultry Food, Blatchford's Calf Meal, Pioneer Clover Meal, carob bean, carob bean pods, carob beans and pods, Barnes's Horse and Stock Feed, Bowker's Animal Meal, and Lederer's Poultry Food.

"No cases of actual adulteration have been found among the samples examined. A considerable number of these 'feeds,' notably most of the so-called 'oat feeds,' are, however, of such inferior quality that they can not be used to any profit.

"It appears that the three most concentrated feeds, the three which, pound for pound, will go farther in 'balancing' or piecing out the ration made from home-grown feed, viz, cotton seed, linseed, and Atlantic gluten meal are the most costly. This is as it should be. Yet of these, the one which contains the most protein, 'Atlantic gluten meal,' is the cheapest. It does not follow that it should be bought to the exclusion of the others. Linseed meal, though a very expensive feed, is greatly relished by cattle, flavors the food and is generally regarded as an excellent thing to keep cows 'in condition.' But evidently the wise feeder will endeavor to use the cheaper forms of protein as far as possible.

"An examination of the prices and analyses of the feeds given in the table also shows that the market prices bear very little if any relation to their feeding value. That is, 'feed' costs from $17 to $20 per ton at retail, whether it is concentrated, rich in protein, and well suited to supplement the home-grown feed, or whether it is a starchy food and of much less value in compounding suitable cattle rations. In this condition of the market, special care in the purchase of feeds and some knowledge of their chemical composition will be found highly advantageous in keeping the cost of milk production down to a point which will admit of profit in the business."

Analyses of feeding stuffs, H. A. HUSTON and A. H. BRYAN (*Indiana Sta. Rpt. 1899, pp. 67-72*).—Analyses are reported of large green okra seed, buckwheat, Rauh's stock food, distillery slop, and a number of samples of mangel-wurzels and sugar beets. The protein con-

tent of 2 samples of corn was also studied. Several of the analyses follow:

Composition of okra seed, buckwheat, and distillery slop.

	Water.	Protein.	Fat.	Nitrogen-free extract.	Crude fiber.	Ash.	Albuminoid nitrogen.	Amid nitrogen.	Starch.*a*	Carbohydrates.	Pentosans.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Large green okra seed.	6.45	22.18	15.98	27.20	23.99	4.20	3.350	0.192	14.06	*b*13.15	......
Buckwheat...........	9.22	13.62	2.72	62.43	10.25	1.76	1.65	.53	53.28	*c*6.01	6.82
Distillery slop........	95.78	1.22	.38	2.31	.29	.02	.144	.048	.63	*c*.38	....

a Diastase method. *b* Extracted by $1\frac{1}{4}$ per cent sodium hydrate. *c* Extracted by dilute sodium hydrate.

Analyses of feeding stuffs, F. W. Woll (*Wisconsin Sta. Rpt. 1899, pp. 271–274*).—The author reports the composition of the following feeding stuffs: Blood-molasses feed (sample manufactured in Denmark), flour middlings, bibra cake (from the Hawaiian Islands), condimental food, broom-corn millet seed, yellow corn germ, white corn germ, wild rice, *Zizania aquatica*, parched and sun dried. A number of these are quoted in the following table:

Composition of a number of feeding stuffs.

	Moisture.	Protein.	Ether extract.	Nitrogen-free extract.	Crude fiber.	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Blood-molasses feed	5.72	20.74	3.22	65.27		5.05
Bibra cake....................................	5.31	*a*20.25	4.82	50.41	10.61	8.60
Broom-corn millet seed (*Panicum miliaceum*)	11.30	*b*9.44	3.81	61.14	10.76	3.55
Wild rice, parched..........................	9.54	13.00	.86	74.04	1.12	1.44
Wild rice, sun dried.........................	9.99	13.65	.88	72.68	1.22	1.58

a Containing 0.14 per cent amid nitrogen. *b* Containing 0.8 per cent amid nitrogen.

"[The blood molasses] shows a medium content of protein. A good share of this component is most likely in the form of amids and lower nitrogenous compounds, which possesses an inferior feeding value as compared with protein substances proper. The feed is, however, made up of foods of high nutritive value. . . .

"Bibra cake is one of the cattle foods used in the Hawaiian Islands. Its price is given as $40 per ton. A comparison with our standard protein foods will show that it is much lower in protein than these and its crude fiber content is rather high, making it a less valuable feed than, for example, any of our oil meals. . . .

"The 2 samples of wild rice were obtained from Lac Courte Oreille Indian Reservation in Wisconsin. . . . Wild rice grows to a large extent in lakes and streams in the northern part of our State, and is used extensively by the Indians as a cereal crop. We notice that it ranks higher than any of our leading cereals in chemical composition, its contents of protein and nitrogen-free extract (mainly starch) being greater than those found in any of these. So far as can be judged from chemical analysis alone, wild rice has, therefore, a high food value."

Winter v. spring bran, W. Frear and W. A. Hutchison (*Pennsylvania Sta. Bul. 48, pp. 8*). Analyses are reported of 10 samples of bran from winter wheat and a like number of samples from spring wheat.

On the basis of these analyses, the 2 sorts of bran are compared, other American work on the subject being quoted. The authors' conclusions follow:

"On the average, despite the higher market price, winter bran furnishes a smaller quantity of nitrogenous nutrients to the animal because of its inferiority in composition, and, possibly, of its lower digestibility. The composition of these brans is not at all constant in regard to the more important constituent, protein. In the case of winter bran, the best contained one-tenth more than the poorest; in the case of spring bran, the best contained over one-fifth more than the poorest. In other words, 9 tons of the best winter bran would furnish as much protein as 10 tons of the poorest; while among spring brans, 8 tons of the best would supply as much protein as 10 tons of the poorest.

"As represented by these analyses, Maine and Massachusetts, maintaining an official control over the sale of cattle foods, secure a somewhat less variable article, and, especially in case of winter bran, a better average article than is obtained in Pennsylvania. The number of analyses represents too small a part of the trade in these foods to justify sweeping conclusions. By reason of its great variability in food value as indicated by analysis, bran should not be bought in large quantities except under guaranty of composition."

Contribution to the study of the energy content of human urine, M. TANGL (*Arch. Anat. u. Physiol., Physiol. Abt., 1899, Sup. pt. 1, pp. 251-266*).—The author reports a number of experiments on the nitrogen and carbon content and fuel value of human urine when different diets were consumed. The balance of income and outgo of nitrogen was also determined. The principal conclusions follow:

The ratio of the heat of combustion to nitrogen and that of carbon to nitrogen in the urine is much greater when the diet consists largely of carbohydrates than when it consists principally of fat. In other words, these ratios can be markedly influenced by diet. Under the conditions of the author's investigations, these quotients varied correspondingly. The 2 ratios did not change when work was performed. This is in harmony with the results of experiments in which the respiration quotient was determined and the theory of Zuntz and his followers, that during rest and work the same proportion of nutrients is metabolized—that is, the proportion of those nutrient materials which the organism has available in sufficient quantity. The article contains a bibliography of the subject.

Sheep feeding, R. T. SHAW (*Montana Sta. Bul. 21, pp. 13*).—The author discusses the possibility of profitably fattening lambs in Montana instead of shipping them for this purpose to other regions, and believes it is possible to raise an abundance of suitable forage crops for the purpose. The comparative value of alfalfa, red clover, and alsike hay was tested with 3 lots, each containing at the beginning of the test 16 grade Merino lambs showing Cotswold blood, weighing on an average $42\frac{1}{5}$ lbs. All the lambs were fed pulped turnips and a grain ration, which at first consisted of $1\frac{1}{4}$ lbs. of oats per head daily. The amount

of oats was afterwards increased and a little flaxseed and cracked peas (pea screenings) added. In addition lot 1 was fed alsike hay; lot 2, red clover hay; and lot 3, alfalfa hay. Both the alfalfa and red clover hay were from second cuttings, and the alsike from the first cutting. One of the lambs in lot 3 was dropped on account of bloating.

The test proper began January 2, 1898, and continued 84 days.

The financial statement is based on oats at $1, pea screenings 50 cts., flaxseed $1.50, and roots at 9 cts. per hundredweight, and hay at $6 per ton. The following table summarizes the results of the tests:

Alfalfa, red clover, and alsike hay for lambs.

	Feed consumed.					Total gain.	Feed consumed per pound of gain.		Cost per pound of gain.
	Hay.	Turnips	Oats.	Flaxseed.	Peas.		Hay.	Grain.	
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Cents.*
Lot 1 (16 lambs; alsike hay)	2,562	1,340	780	42	241	405	6.32	2.62	4.51
Lot 2 (16 lambs; red clover hay)	2,588	1,340	780	42	241	402	6.43	2.64	4.62
Lot 3 (15 lambs; alfalfa hay)	2,484	1,340	780	42	241	377	6.58	2.81	4.82

"(1) With the great abundance of leguminous crops and the ease with which they can be produced in Montana, we believe it would be of great advantage to the Montana farmer to fatten at least a few sheep each winter season.

"(2) Under the very favorable climatic conditions the amount of food required and cost of production per pound gain are relatively small.

"(3) Careful comparison has shown that alsike, the red clovers, and alfalfa have given results for feeding value in the order named.

"(4) Food materials which would otherwise be wasted can be utilized with profit where sheep are kept on the average farm."

Sheep-feeding experiments, J. H. STEWART and H. ATWOOD (*West Virginia Sta. Bul. 61, pp. 67–75*).—The usual practice in West Virginia, according to the authors, is to market in the fall lambs raised for mutton. The possibility of profitable winter fattening of lambs was tested in 2 trials. The first trial was made with 2 lots of Southdown and Shropshire grade lambs and "natives, such as could be found in any section of the State," and 1 lot of native yearling wethers. Lot 1 (8 ewe lambs and 2 wethers) and lot 3 (5 yearling wethers) were fed a grain ration consisting of equal parts of linseed meal, wheat bran, and hominy feed. Lot 2 (8 ewe lambs and 2 wethers) was fed whole corn. All 3 lots were fed, *ad libitum*, mixed clover and timothy hay which was not thought to be of extra quality. The test covered 8 weeks. The average gain per lamb in the different lots was 14.5, 15.4, and 8.8 lbs., respectively; and the cost of feed per pound of gain was 4.9, 3.7, and 10.7 cts. The wether lambs gained on an average 18.4 lbs., while the ewe lambs gained only 14.1 lbs. The value of the manure is taken into account.

"Although definite conclusions should not be drawn from one experiment, yet this feeding test indicates that lambs can be fattened more profitably than yearling wethers, and that under favorable conditions it may be better for farmers who have an abundance of coarse fodder to feed their lambs heavily for 8 or 10 weeks, instead of selling them at the usual time in the fall. It also indicates that forage and grain produced upon the farm may be sold at home for a higher price than the market offers."

A second test in the fall of 1898, with 60 lambs, was discontinued on account of many of the lambs being seriously affected with an internal parasite. The indications were that cowpea hay was superior to timothy hay, although the gains were unsatisfactory in all of the lots.

Feeding ground corn v. ground peas to lambs before and after weaning, W. L. Carlyle (*Wisconsin Sta. Rpt. 1899, pp. 44–51, figs. 2*).—For the past 10 years the station has studied the feeding value of different grains for lambs before and after weaning (E. S. R., 11, p. 567). In the present test, coarsely ground corn and ground peas were tested with 2 lots of 17 lambs each, before and after weaning. The dams (11 Shropshire ewes per lot) were with the lambs until weaned. The lambs and ewes were pastured on blue grass during the day and housed during the night. Lot 1 was fed ground corn and lot 2 ground peas. Until weaning the grain was fed *ad libitum;* after weaning it was fed at the rate of about ½ lb. per day. The ewes were not fed grain. The test began May 24, 1898, and was divided into 2 periods of 10 weeks each, the lambs being weaned at the close of the first period. In discussing the financial returns, corn is rated at 30 and peas at 45 cts. per bushel. Previous to weaning, the average daily gain of lot 1 was 8.7 lbs., and of lot 2, 8.9 lbs., the grain required per pound of gain with the 2 lots being 0.883 lb. and 0.889 lb. After weaning, the average daily gain of the 2 lots was 6 and 5.1 lbs., respectively; the corresponding amounts of grain required per pound of gain being 2.11 and 2.41 lbs. During the whole test the cost of a pound of gain with lot 1 was 0.752 ct., and with lot 2, 1.085 cts. "Ground corn is a better feed than ground peas, pound for pound, when fed to young lambs, and is much the more economical feed when the average ruling prices of the 2 grains are considered."

At the close of the test, the carcasses of 2 lambs from each lot were compared. "The proportion of lean to fat and the character of the fat as to solidity, color, etc., appeared to be exactly the same in the carcasses of lambs from both the lots."

In connection with the above test, the comparative effect upon the ewe of nursing single and twin lambs, as well as the gains made by single and twin lambs and the comparative gains made by ewe and wether lambs, were also studied.

"A ewe can raise twins without losing any more weight than when raising a single lamb. The ewes losing the most flesh while suckling lambs are not necessarily the best mothers. Wether lambs gain more rapidly than the ewe lambs while nursing. Twin lambs nursing one mother gain as rapidly as when there is but one lamb nursing."

The influence of manures on the production of mutton, W. SOMERVILLE (*Jour. Bd. Agr.* [*London*], *6* (*1899*), *No. 3, pp. 293-310*). In continuation of work previously reported (E. S. R., 10, p. 1084), the value of different fertilizers on poor pasture was tested by comparing the yield of hay and the growth made by sheep pastured on plats fertilized with cotton-seed cake, lime, Thomas slag, dissolved bone, and superphosphate, alone and in combination with potash, with lime, and with ammonia. One plat (No. 6) served for purposes of comparison and was not fertilized. The following table summarizes the results obtained in 1899:

Average results of different methods of manuring pasture as shown in 1899 by production of hay and mutton.

Plats.	Treatment.	Hay in excess of amount produced by plat 6.	Mutton in excess of amount produced by plat 6.	Hay consumed per pound of gain in live weight of sheep.	Average live weight of sheep.	Average dressed weight of sheep.
		Per cent.	*Per cent.*	*Pounds.*	*Pounds.*	*Pounds.*
1	Cotton-seed cake	16	139	21.4	115.5	53.5
2	Lime	14	1	38.8		
3	Full dressing of slag	97	233	20.8	127.0	57.5
4	One-half dressing of slag	68	96	30.1	117.5	53.5
5	Superphosphate	47	91	27.0	114.0	53.0
6	Nothing			35.1		
7	Superphosphate and potash	28	117	20.6	120.5	53.5
8	Superphosphate and lime	18	119	23.6	122.5	54.5
9	Superphosphate and ammonia	54	104	26.7	126.0	57.0
10	Dissolved bone	54	104	26.7	122.5	57.0

The effect of the different manures is discussed at some length and the results of this test are compared with those obtained earlier. When slaughtered the sheep were judged by an expert. Those pastured on plat 6 were considered the best mutton. Those on plats 1, 3, and 4 next in order, followed by those on plats 10, 5, 7, 8, and 9, which were much alike. The sheep were said to be much like others slaughtered the same season, which was very dry. They showed a lack of kidney fat and made small gains. In the author's opinion, grazing the sheep is the best method of testing the comparative value of the different fertilizers. However, it should be remembered that after the sheep were taken from the plats there still remained a considerable amount of fodder, the amount varying in the different plats.

"This feed has been utilized by cattle with which the plats were stocked in proportion to apparent requirements, a note being kept of the duration of the respective periods of grazing. The 30½ acres have each autumn maintained 18 breeding cattle for fully 2 months, and that they found enough to eat is proved by the fact that they came off in excellent condition. Allowing 24 cts. per head per week for grazing, the plats are credited with sums varying between \$2.40 (plat 6) and \$4.85 (plat 3) per acre."

Whole corn compared with corn meal for fattening swine, W. A. HENRY (*Wisconsin Sta. Rpt. 1899, pp. 19-24*). Continuing previous work (E. S. R., 11, p. 571), the comparative value of whole and ground corn was tested with 2 lots of 19 pigs each, containing 9

sows and 10 barrows. Five pigs in each lot were pure-bred Poland China, the others Berkshire-Poland Chinas. These were the same pigs used in the experiment with rape and clover mentioned below. After a preliminary period of 1 week, the test began November 19 and covered 84 days. Lot 1 was fed whole corn and middlings; lot 2, corn meal and middlings. The total weight of lot 1 at the beginning of the test was 3,543 lbs. and of lot 2, 3,538 lbs. During the test lot 1 consumed 7,084 lbs. of shelled corn and 3,542 lbs. of wheat middlings, and gained 2,132 lbs. That is, 4.97 lbs. of corn meal and middlings were required for a pound of gain. Lot 2 consumed 7,196 lbs. of corn meal and 3,598 lbs. of middlings, and gained 2,132 lbs., the grain required per pound of gain being 5.07 lbs. Discussing this test and previous trials, the author says:

"It is evident from our work as conducted to the present time that the gains from grinding corn as a food for swine are not very large in most cases and negative results may be obtained. It is expected that the work will be continued for some time to come or until we shall know more definitely what the real advantages are, if any, of grinding corn for fattening swine."

Rape v. clover for young pigs, W. L. Carlyle (*Wisconsin Sta. Rpt. 1899, pp. 25-30, figs. 2*).—The comparative value of rape and clover for young growing pigs was tested with 2 lots, each containing 21 pure-bred and high-grade Berkshires and Poland Chinas, averaging a little over 100 lbs. in weight when the test began. (For earlier work see E. S. R., 11, p. 571.) The 2 lots were fed a grain ration of middlings and corn meal 1:2 mixed with water into a thick slop 12 hours before feeding. In addition lot 1 was fed rape. The pigs were confined by a portable fence, being moved as required. They were somewhat slow in acquiring a taste for the rape, but at the end of a week of the preliminary feeding they ate it greedily. In addition to grain lot 2 was pastured on about 8 acres of second growth clover. The test covered 4 periods of 2 weeks each. During this time the pigs in lot 1 ate the rape from about ¾ acre. At the beginning of the test the pigs in the 2 lots weighed 2,139 and 2,138 lbs., respectively. The corresponding average daily gains of the 2 lots during the test were 1.27 and 1.22 lbs. The results are compared with those obtained in previous years. In discussing this year's tests the author remarks that—

"The pigs fed on the rape appeared more paunchy as a whole at the close of the experiment than were those fed on clover, though they were all of the same breeding and very uniform as to conformation when the experiment began.

"Another year's experience in pasturing pigs on rape serves to strengthen the conclusion of last year, viz., that farmers feeding any number of pigs can not provide a better pasture for them than to sow small plats of rape at successive periods about 3 weeks apart during the spring and early summer months to be used for pasturage for their sows and young pigs."

On the food requirements of the pig for maintenance and for gain, W. DIETRICH, reported by F. W. WOLL (*Wisconsin Sta. Rpt. 1899, pp. 31-43*).—The amount of food required at different weights for maintenance and for growth was tested with 4 pigs weighing about 50 lbs. each at the beginning of the trial. The general plan was to diminish the ration until the smallest quantity which would maintain the pigs at a constant weight was ascertained. Feeding was continued until it was certain that the ration was sufficient for maintenance. The ration was then increased and the pigs fed until they weighed 100 lbs. each, when the amount necessary for maintenance at that weight was determined. In this way the maintenance ration was also determined for pigs at 150 and 200 lbs. live weight.

The pigs used were 2 barrows and 2 sows, all from the same litter, and were a cross between a pure-bred Berkshire sire and a Poland China-Chester White sow. They were 81 days old at the beginning of the trial, which began July 13, 1898, and closed April 1, 1899. It was divided into 4 periods of 56, 58, 71, and 74 days, respectively. During the first period the ration consisted of corn meal and wheat bran, 1:2, mixed with buttermilk and a little water, the nutritive ratio being 1:4. During a part of the time skim milk was used in place of buttermilk. During the second period the ration consisted of corn meal, middlings, and skim milk, 1:1:4, with a little rape in addition. The nutritive ratio was 1:5. During the third period the nutritive ratio was changed to 1:5:7, the food consisting of corn meal, middlings, and skim milk, 1:1:2. During the fourth period the feed was changed to corn meal and middlings, 1:2, the nutritive ratio being 1:6. The pigs did not eat as much after this change as they had done previously and the feed was therefore reduced from the allowance during the third period. The feeding stuffs used were analyzed. "The fifty-pound pigs were each maintained on a ration containing 0.15 lb. of corn meal, 0.15 lb. of middlings, and 1.2 lbs. of skim milk; at 100 lbs. weight it took 0.4 lb. of corn meal, 0.4 lb. of middlings, and 1.6 lbs. of skim milk; at 150 lbs. weight it took 0.8 lb. of corn meal, 0.8 lb. of middlings, and 1.6 lbs. of skim milk; and finally at 200 lbs. the pigs required 0.67 lb. of corn meal and 1.33 lbs. of middlings each for maintenance." The dry matter required daily for maintenance in the 4 periods was 0.37, 0.87, 1.54, and 1.76 lbs., respectively. The dry matter required per pound of gain in the 4 periods was 2.24, 2.08, 3.12, and 3.96 lbs., respectively, and the average daily gain in the 4 periods was 0.93, 1.66, 1.85, and 1.22 lbs. The number of days required for 50 lbs. of gain by the pigs at different weights was also computed. The pigs weighing 50 lbs. required 54 days; at 100 lbs., 30 days; at 150 lbs., 27 days, and at 200 lbs., 41 days.

"We observe that the older the pig grows the greater becomes the [relative amount of food required for maintainance] and the greater the amount of food required to produce 100 lbs. of gain. But considering that the percentage of the food is small in proportion to the total food eaten at the 150-pound stage and that here the pig consumes a large quantity of food per day and makes a large gain, it would seem that the 150-pound pig is the most profitable one to feed. The large percentage of food for maintenance to live weight is counterbalanced by these other facts. This appears all the more evident when we consider what a small quantity of food was consumed per day by the 200-pound pig. When we consider that the 200-pound pig ate only 2.41 lbs. of dry matter per 100 lbs. of live weight and that 36 per cent of this goes to sustain the life of the animal, we can easily see why the daily gain dropped from 1.85 lbs. per day with the 150-pound pig to 1.22 lbs. per day with the 200-pound pig. . . .

"During the maintenance period the pigs did not show much greater signs of hunger than when on full feed, but a few days, when they were given less than maintenance allowance, they appeared to suffer from hunger. They seemed to feel well during the maintenance feeding and would sometimes run about and play like young dogs; when on full feed they were lazy and would lie about in the pen. . . .

"It was noticed that some pigs were slower eaters than others, and this may explain why better results are not obtained when the animals are fed together in large numbers. It was also noticed that the best results were obtained when the pigs were on a feed increased uniformly from day to day."

During all periods of gain the tails were curled. During maintenance periods the tails of the pigs hung straight down. "The curl in the tail appeared and disappeared as the change was made from maintenance to full feed and *vice versa*."

In connection with the above experiment the digestibility of the maintenance ration and the ration for growth was tested with 2 pigs for 2 periods of 3 days each. "It appears that a pig will digest a little more food when on a maintenance ration than when supplied with as much food as will be eaten." These results are compared with those obtained at the Minnesota Station (E. S. R., 4, p. 733).

Nuts as food, C. D. Woods and L. H. Merrill (*Maine Sta. Bul. 54, pp. 71-92*).—Statistics of the amount of nuts imported into the United States are quoted and the composition of a number of nuts analyzed at the station reported. These include Brazil nuts (*Bertholletia excelsa*), filberts, hickory nuts, pecans, peanuts, peanut butter, edible acorns called "biotes" (*Quercus emoryi*), acorn meal, acorn bread, beechnuts, butternuts (*Juglans cinerea*), cocoanut, cocoanut milk, litchi nuts (*Nephelium litchi*), pine nuts (*Pinus monophylla, P. edulis, P. sabiniana*), and pistachio nuts. The authors also quote a considerable number of American analyses of nuts made by other investigators. The characteristics of the different nuts are discussed as well as their preparation and use as articles of diet.

Analyses of maple sugar, H. A. Huston and A. H. Bryan (*Indiana Sta. Rpt. 1899, pp. 74, 75*).—The composition of 4 samples of maple sugar and a sample of what is known to maple-sugar makers as "niter" or "sugar sand" is reported. The sugar sand had the following percentage composition: Water, 6.11; insoluble matter, 9.13; reducing sugars, 12.74; sucrose, 26.88; calcium, 12.89; malic acid, 20.86; potash, 0.72; protein, 0.40; and magnesium, a trace. According to the authors, this material is sometimes known as "malate of lime." It is suggested that it might be of some value as a source of malic acid.

Liebig Company's extract of meat (*Sci. Siftings, 17* (*1900*), *No. 343, p. 230*).—The food value of this meat extract is discussed and an analysis reported.

Indian edible oils, W. R. Dunstan (*Agr. Ledger, 1899, No. 12, Veg. Prod. ser. No. 52, pp. 1–34*).—A report on the chemical and physical examination of a large number of vegetable oils used for culinary purposes in India.

State of Michigan Dairy and Food Department Bulletin 55 (*pp. 27*).—This bulletin contains a discussion of process butter, an article entitled "Method for the detection of process or renovated butter" by W. H. Hess and R. E. Doolittle, a report of the inspections made by the department, a report by the department chemist of the examination of a number of samples of butter, cinnamon, flavoring extracts, ginger, jelly, fruit butter, molasses, mustard, pepper, sirup, and vinegar. An abstract of the Michigan pure-food laws and a number of court decisions under them are also given.

State of Michigan Dairy and Food Department Bulletin 56 (*pp. 18*).—This bulletin discusses the work of the dairy and food department, reports legal proceedings, dairy inspections, analyses of samples of beans, buckwheat flour, butter, flavoring extracts, ginger, honey, jelly, mustard, peas, pepper, rice, sugar, and wine. The Michigan food laws are noted, together with a digest and rulings.

Character and extent of food and drug adulteration in Massachusetts, and the system of inspection of the State board of health, A. E. Leach (*Tech. Quart., 13* (*1900*), *No. 1, pp. 22–40, figs. 2, pls. 3*).—A paper read before the Boston Society of Arts, December, 1899, describing the common forms of adulteration and the methods followed in combating adulteration and sophistication of food and drugs.

Bacteriology applied to the canning and preserving of food products, E. W. Duckwall (*Baltimore: The Trade, 1899, pp. 112, figs. 24*).—The major portion of this publication treats of the nature and character of bacteria, including pathogenic species, methods of propagating, kinds commonly found in decomposing fruits and vegetables, methods of studying bacteria, summary of the characteristics of the various organisms found in food products, and the scientific principles involved in canning and preserving.

Chapters are also given on antiseptics and germicides, history of canning, methods of canning corn, peas, tomatoes, tomato products, oysters, meats and fish in general, pickles, kraut, and soup. Some results of sterilizing experiments are included in the work and a chapter given on sterilization in canning.

The food rations in Ladysmith, J. C. Dunlop (*British Med. Jour., 1900, No. 2046, pp. 667, 668*).—The food value of the rations issued to the soldiers and other inhabitants of Ladysmith during the latter part of the recent siege is calculated to be 73.4 gm. protein and 1,527 calories per man per day.

The feeding of prisoners, F. Hirschfeld (*Ztschr. Diätet. u. Phys. Ther., 4* (*1900–1901*), *No. 1, pp. 37–53*).—The dietary in a Berlin prison was studied, and in addition 4 nitrogen metabolism experiments were made.

Concerning the metabolism of a vegetarian, T. Rumpf and O. Schumm (*Ztschr. Biol., 39* (*1899*), *No. 1, pp. 153–158*).—The subject of this investigation was a strict vegetarian. During his youth he had eaten eggs, butter, milk, and cheese, but since his eighteenth year vegetable food only. His parents were also vegetarians. During 8 days the amount of food consumed was recorded and the urine and feces were analyzed. The food consisted of Graham bread, apples, dates, Quaker oats, rice, sugar, and walnuts. The diet furnished 73.88 gm. of protein, 28.64 gm. of fat, 698.21 gm. of carbohydrates, and 3,431.92 calories. The daily income of nitrogen was 11.82 gm.; 6.91 gm. was excreted in the urine and 4.01 gm. in the feces. There was, therefore, on an average, a gain of 0.9 gm. per day. The food contained 28.64 gm. of fat, and the feces 7.58. The subject weighed 62.5 kg. at the beginning, and gained 1.7

kg. during the experimental period. In the authors' opinion, the vegetable diet somewhat more than sufficed for maintenance.

Ensilage without pressure, Ross (*Agr. Gaz. New South Wales, 11 (1900), No. 1, pp. 36, 37*).—The author's experience, extending over a number of years, in ensiling maize in stacks without pressure is given. This method of preserving maize is regarded as entirely satisfactory. "The stack is an absolute success except for the slight loss at the top and sides."

The foundation principles in determining feeding standards for farm animals, L. GRANDEAU (*Jour. Agr. Prat., 1900, I, No. 10, pp. 344–346; 11, pp. 381, 382*).—A general discussion.

Feeding experiments with different quantities of the same foods at the college farm, T. WINTER (*Bd. Agr. [London] Rpt. Distrib. Grants for Agr. Ed. Great Britain, 1898–99, pp. 48–52*).—A feeding experiment conducted at the University College of North Wales with 2 lots of 4 steers each, averaging about 1,100 lbs., is briefly reported. The object was to compare a ration of 3 lbs. of maize meal and 3 lbs. of decorticated cotton-seed cake with one containing 5 lbs. of each of these, feeding pulped Swedish turnips, chaffed hay and straw in addition.

The test began November 29, 1898, and closed February 8, 1899. The steers receiving 6 lbs. of grain made an average daily gain of 1.92 lbs., and those receiving 10 lbs. made an average daily gain of 1.65 lbs. The steers were slaughtered at the close of the test. The average percentage of dressed to live weight in the 2 lots was 53.2 and 55.7 respectively.

Feeding experiments with root crops, L. HELWEG (*Landtmannen, 10 (1899), Nos. 47, pp. 774–777; 48, pp. 790, 791; 50, pp. 820–824*).

Cost of feeding steers, L. McKIM (*Wallace's Farmer, 25 (1900), No. 15, p. 410*).—A general discussion which includes some statistics.

DAIRY FARMING—DAIRYING.

The mammary gland, A. W. BITTING (*Indiana Sta. Rpt. 1899, pp. 36–43, pls. 5*).—An account is given of the anatomy and physiology of the mammary gland and its development in different types of Mammalia, particular attention being paid to the form, structure, and vascular supply of the cow's udder.

"The udder of the cow consists of a variable number of mammary glands, usually 4 that are functional (the quarters) and from 1 to 4 that are rudimentary. They are arranged in pairs, being on opposite sides of the median line of the body, and occupy the inguinal region (groin). . . .

"The shape and size of the organ as a whole differs in the different breeds and in individuals of the same breed. In some breeds the aim has been to develop a large secretory function, and an enormous glandular development has been the result. In other breeds the quality of the milk has been the prime consideration, and the gland is smaller. In the beef breeds the gland is often invaded with fatty tissue and the udder appears large, but the quantity of glandular tissue is small. . . .

"The weight of the dissected udders, as found in our investigations, varied from 2 lbs. and 3 oz. to 41 lbs. and 6 oz. . . .

"A dissection of the udder shows that each half is enveloped in a strong fibrous capsule, and that the fibers intermingle on the inner side and are prolonged upward to act as ligamentous support for the gland. The halves are distinct, as they may be easily separated throughout their inner aspect. The individual glands in each half of the udder are not so distinctly separated. . . .

"The structure of the mammary glands can be studied to advantage by injecting each teat and the arteries and veins with different colored injection masses. Each gland is enveloped in an elastic, fibrous capsule or membrane, to which externally the skin is loosely adherent; internally the fibers intermingle with those of the gland from the opposite side and become prolonged upward as a suspensory ligament. . . .

"Above the teat is a large cavernous opening, the reservoir or milk cistern. This cistern is divided by constrictions into pockets of various sizes, into which the larger milk ducts empty. At the point of entrance of these ducts is a constriction due to a sphincter muscle. These sphincters can not close the entire opening, but it seems possible that they may partially do so, and this may thus account for the condition known to all dairymen as 'holding up the milk.'

"The large ducts ramify in an irregular manner to all parts of the gland. They subdivide into smaller ducts, and these in turn into smaller ones, until they terminate in a simple duct with its alveolus or pocket. The large ducts anastomose very freely, but do not in the smaller subdivisions. The canal in the teat, the reservoir, and ducts are lined with columnar epithelium, but just what part the epithelial cells lining these ducts have in the production of milk is not known.

"The alveolus is the sacculated distension on the end of the minute milk duct. It is the essential part of the gland. It is lined by a single layer of epithelial cells, which are especially concerned in milk secretion. The cavity of the alveolus in the cow is from $\frac{1}{250}$ to $\frac{1}{100}$ of an inch in length, and from 0.13 to 0.08 of an inch in diameter. The lining cells vary from almost a flattened form to a columnar form during the different stages of rest and activity.

"The mammary glands are abundantly supplied with blood. . . . The mammary artery has 4 principal branches, 2 going to the posterior gland, 1 branch between the glands, with nearly all its subdivisions entering the anterior gland. There is also a small branch for each rudimentary gland. The large branches subdivide within the gland tissue. . . . The larger volume of blood passes forward through the subcutaneous veins, thus bringing them into great prominence and giving rise to the popular name of milk veins. These abdominal veins enter the thoracic cavity just behind the sternum on each side of the cartilage, the point of entrance into the body being known as the 'milk well.' As the blood may pass to the heart through the posterior vessels as well as the anterior, it would seem that undue prominence is attached to these veins in judging the milking qualities of cows. If a large volume of blood should return by way of the posterior vessels, the abdominal veins will appear less prominent. One of the factors tending to increase the size of these veins is pressure upon the iliacs, as a gravid uterus. . . .

"The nerve center controlling secretion has not been located, but it is supposed to be in the spinal cord. It is possible that the will can exercise some influence, but the evidence is not sufficiently clear to warrant drawing a positive conclusion."

On the economy of heavy grain feeding of dairy cows, F. W. Woll and W. L. Carlyle (*Wisconsin Sta. Rpt. 1899, pp. 52–67*).—The proportion of grain feed to coarse fodder best adapted for the economical production of milk and butter was studied in an experiment with 2 lots of 4 cows each, lasting 3 months. A ration consisting of 8 lbs. of a mixture of ground oats, ground corn, wheat bran, and old-process linseed meal, 4 lbs. of mixed clover and timothy hay, and silage *ad libitum* was fed to lot A during the first and third periods, and to lot B during all 3 periods. During the second period lot A received the same ration except that the amount of grain was increased

to 12 lbs. In other respects the conditions of the experiment were uniform. The following table summarizes the principal data:

Results of feeding different amounts of grain to milch cows.

	Food consumed.			Total production.		Cost of food per 100 lbs. milk.	Cost of food per pound of fat.
	Silage.	Hay.	Grain.	Milk.	Fat.		
Lot A:	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Cents.*	*Cents.*
Period I (8 lbs. grain)	3,666	500	672	1,811.3	86.91	54.0	11.3
Period II (12 lbs. grain)	3,754	336	1,008	1,739.7	85.83	67.9	13.8
Period III (8 lbs. grain)	3,573	336	672	1,654.5	83.10	56.1	11.2
Average of periods I and III	3,620	418	672	1,732.9	85.01	55.1	11.3
Lot B:							
Period I (8 lbs. grain)	3,876	500	672	2,135.1	92.70	47.2	10.9
Period II (8 lbs. grain)	4,294	336	672	1,976.3	87.27	50.6	11.4
Period III (8 lbs. grain)	4,180	336	672	1,991.6	93.18	49.7	10.6
Average of periods I and III	4,028	418	672	2,063.4	92.94	48.5	10.8

The results are discussed at some length. The ration containing 12 lbs. of grain was considered as fed at a considerable loss as compared with the ration containing 8 lbs. of grain. No increase in the live weight of the animals nor favorable after effects on the production of milk and butter could be attributed to the additional amount of grain fed lot A during the second period. The work is considered as preliminary.

Protecting cows from flies, W. L. Carlyle (*Wisconsin Sta. Rpt. 1899, pp. 92-96*).—A brief account is given of the appearance and life history of 2 species of flies troublesome to cattle, the common stable fly (*Stomoxys calcitrans*) and the horn fly (*Hæmatobia serrata*). Protection from the horn fly may be secured by spraying cows with various substances for this purpose, or by rubbing into their hair some greasy substance, such as fish oil with some oil of tar and sulphur added. Means of this kind and also blanketing were found useless against the more numerous stable flies.

An experiment was conducted to determine the relief from flies by stabling. Fourteen cows were divided into 2 lots as nearly equal in every respect as possible. During the daytime lot 1 was kept in a small paddock having an abundance of shade, and lot 2 in a comfortable stable provided with screen doors and windows. In other respects the 2 lots received the same treatment. The cows in lot 1 were constantly on the move fighting flies, while those in lot 2 were practically free from them. During the 4 weeks which the experiment lasted lot 2 (stabled) consumed 835 lbs. more of green sorghum and sweet corn than lot 1 and lost on an average 19 lbs. more in live weight per cow. Comparing the results of the first 2 weeks of the experiment with the results of the 2 weeks preceding, the yields of milk and butter fat of lot 1 decreased respectively 40.4 and 2.16 lbs., and of lot 2, 56.7 and 0.81 lbs. Similar results were obtained in comparing the first and fourth weeks of the experiment.

"This experiment can not be accepted as in any way conclusive, and yet it would seem to indicate that while the cows in the stable increased slightly more in the percentage of butter fat in their milk than did the lot in the paddock, yet they ate more of the feed and fell off more in the amount of milk given, though they decreased much less in total fat production. It is easily seen, however, that the increase in the total amount of butter fat given in the one lot over the other in this experiment was not sufficiently great to pay for the increased trouble and expense entailed in the stabling of the cows during the greater part of every day."

The effect on dairy cows of changing milkers, W. L. CARLYLE (*Wisconsin Sta. Rpt. 1899, pp. 89–91*).—The effect of the constant changing of milkers was studied with 8 cows in advanced stages of lactation. The experiment covered 5 periods of 4 days each. During the first, third, and fifth periods and for several days preceding each, the milking was done by the regular milkers. During the second and fourth periods each cow was milked by a different person at each successive milking. None of the milkers were strange to the cows. The data for the experiment are tabulated. With the regular milkers the average yield of al! the cows for 4 days was 69.29 lbs. of milk, with an average fat content of 4.75 per cent. With changing milkers the yield of milk was 73.73 lbs. and the fat content 4.85 per cent.

"While the results would seem to show that there is a slightly increased production, on the average, from the constant changing of milkers, yet the increase is so slight that very little importance can be attached to it. The results of this experiment are important, however, in that they go to show that when all the cows in a herd are kindly treated by all the milkers, a changing of the milkers of the individual cows in the herd has no appreciable effect upon the milk and butter produced and it appears as if the cows appreciated a change."

Dairy herd record, W. L. CARLYLE (*Wisconsin Sta. Rpt. 1899, pp. 68–88, figs. 14*).—A dairy herd comprising 6 grade Jerseys, 6 grade Guernseys, and 6 grade Shorthorns was purchased to compare the cost of the milk and butter production of cows of the special-purpose dairy type, represented by the Jersey and Guernsey grades, and cows of the dual-purpose type, represented by the Shorthorn grades. The animals were of the highest dairy type of the breed and class to which they belonged. They were given the same care and treatment. Tables show the breed, age, and weight of cows; kind, amount, and cost of food eaten; number of days in milk; yields of milk and butter; and the value of products and total profit for each of 14 cows which were in the herd during the entire year. Of this number 3 were grade Jerseys, 5 grade Shorthorns, and 6 grade Guernseys. The average profit over cost of feed from each of these breeds was, respectively, $59.05, $50.71, and $55.47 per cow. A grade Shorthorn gave the largest yield of milk and butter. The results of this preliminary work, while not considered conclusive, show a favorable comparison of the Shorthorn grades with the Jersey and Guernsey grades in the cheapness of butter production. An illustration is given of each of the 14 cows,

accompanied by descriptive and historical notes and a summary of her production and profit.

The composition of sow's milk, F. W. WOLL (*Wisconsin Sta. Rpt. 1899, pp. 267-270*). One sample of milk from each of 2 pure-bred Poland China, 1 pure-bred Berkshire, and 2 grade Berkshire sows was secured in a manner similar to that described in an earlier report (E. S. R., 10, p. 782), and analyzed. The results of the 5 analyses, together with those of 7 analyses reported before, are summarized in the following table:

Composition of sow's milk.

	Lowest.	Highest.	Average.
	Per cent.	*Per cent.*	*Per cent.*
Water	79.46	83.13	81.49
Fat	3.89	8.53	6.60
Casein and albumen	4.55	7.28	5.75
Milk sugar	3.07	6.20	5.19
Ash	.74	1.32	.97
Solids-not-fat	10.76	13.23	11.91

The results of 74 analyses made by the author and other investigators give 6.61 per cent as an average fat content of sow's milk. This is considered nearly 3 per cent higher than the average fat content of cow's milk produced in the United States. "Chemical analyses and microscopic examinations of the two kinds of milk show that sow's milk is more like the milk of strippers than that of cows in full flow of milk."

Pasteurization of milk and cream at 140° F., E. H. FARRINGTON and H. L. RUSSELL (*Wisconsin Sta. Rpt. 1899, pp. 129-139, figs. 3*).—The conditions of efficient pasteurization, thermal death point of the tubercle bacillus, and the cause of diminished consistency of pasteurized products are discussed, and studies on pasteurization at 140° F. are reported.

Samples of unpasteurized milk, and milk pasteurized at 140° F. for periods varying from 15 to 60 min., and at 155° for 15 min., were kept in cold running water, and the thickness of the cream layer formed in each case was determined at diffierent intervals. The creaming property of the milk pasteurized at 140° was practically the same as that of the unpasteurized milk. As compared with normal milk the creaming of the milk pasteurized at 155° was retarded and lessened in quantity.

A number of tests were made to determine the keeping quality of milk pasteurized at 140° F. On the average unpasteurized milk remained sweet about 2 days. Milk pasteurized at 155° F. for 15 min. and at 140° for 15 and 30 min. remained sweet over 6 days with practically no difference in the 3 cases.

Determinations were made of the number of bacteria in samples of

milk heated for 20 min. at temperatures ranging from 45 to 70° C. Over 99 per cent of the bacteria present in the unpasteurized milk was destroyed by pasteurization at 140° F.

Viscometer tests made according to the method previously described (E. S. R., 9, p. 181) showed practically no difference in the consistency of raw cream and cream pasteurized at 140° F. for 30 min.

The following summary is given:

"The temperature recommended for the pasteurization of milk and cream in the past has been 155° F. for a period of 15 to 20 minutes. This limit was chosen because it had been regarded as the point at which the tubercle bacillus is destroyed in a moist medium. When, however, cream or milk is heated to a temperature of 140° F. or above, the physical condition of the fat globules is changed so that cream appears much thinner and milk loses its property of rapid creaming. This objection can be overcome, as is shown by the preceding experiments, if milk or cream is not heated above this temperature.

"Not only is the creaming property of the milk, and the 'body' or consistency of cream unaffected, but the keeping quality is practically as good as it is where the product is heated to a temperature of 155° F. All that is necessary to secure good keeping quality is to destroy the vegetative bacteria, and as this is accomplished at the temperature of 140° F. if the exposure is made for a sufficient period of time, no advantage in this respect is to be gained by heating to a higher temperature. This being true, it only remains to determine with certainty how long an exposure must be made to destroy the tubercle bacillus. The temperature limit that has heretofore been considered necessary where the exposure was made at 140° F. was 1 hour, but recent extensive experiments by Theobald Smith, in which all conditions have been most carefully controlled, show that this time can be materially shortened where milk is agitated during pasteurizing. A thorough retest of this point is now being made under factory conditions and the exact time period will be determined on the basis of these trials."

Pasteurization of skim milk, E. H. FARRINGTON (*Wisconsin Sta. Rpt. 1899, pp. 121-128, figs. 2*).—The methods and advantages of pasteurizing skim milk at creameries are discussed, and a device for heating skim milk by means of exhaust steam, constructed by J. C. Fortiner of the University creamery, is described.

This skim-milk heater consists of an ordinary tin pail which is suspended over the storage vat, and into which the pipe conveying the skim milk from the separator and the one conducting the exhaust steam from the creamery engine empty. The skim-milk pipe extends about 18 in. up into the steam pipe, which arrangement is thought to aid in utilizing all the heat of the exhaust steam and to prevent the skim milk from being blown from the pail by the steam. The skim milk is thus heated as it comes from the separator and flows over the top of the pail into the large vat from which the patrons of the creamery are supplied. In practice about 2,500 lbs. of skim milk per hour was heated to 160° F. and 4,000 lbs. to 140°. It was found that skim milk heated in this way remained sweet about 1 day longer than skim milk not heated. Only perfectly sweet milk can be used where this method of pasteurizing the skim milk is employed.

A valve for turning aside the exhaust steam when not needed for pasteurizing is illustrated. Brief mention is also made of an arrangement in practical use in a creamery by which the skim milk was heated in a similar manner at the separator.

Effect of salt on the water in butter, E. H. FARRINGTON (*Wisconsin Sta. Rpt. 1899, pp. 97–107, fig. 1*).—Reference is made to results of similar work reported previously (E. S. R., 11, p. 586).

In each of 18 experimental churnings the butter was divided into 2 lots, one of which was salted and the other not salted. In other respects the 2 lots in each case received as nearly identical treatment as possible. In a number of these trials both lots were worked once, and in the other trials the lots were worked twice, the 2 workings being separated by an interval of about 24 hours. Analyses of 36 samples of butter made in these trials are given in full and summarized in the following table:

Average of analyses of salted and unsalted butter.

	Number of churnings.	Salted butter.				Unsalted butter.			
		Butter fat.	Curd.	Ash (salt).	Water.	Butter fat.	Curd.	Ash (salt).	Water.
		Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
Butter worked once	8	83.80	0.93	2.74	12.74	83.86	0.90	0.27	15.12
Butter worked twice	10	84.59	1.08	3.80	10.53	84.58	.96	.36	14.33

While the unsalted butter always had a dry appearance it was found in every comparison to contain more water than the salted butter.

"Taken as a whole, the analyses show that the higher the salt content, the less water the butter will contain. . . . The amount of water or brine that shows on the fresh-cut surface of butter is a better indication of its salt content than of the amount of water it holds. . . . The color of the salted butter was a darker shade of yellow than the unsalted. This was very noticeable."

To observe the effect of the size of butter granules on the water content of butter, about 300 lbs. of ripened cream was divided into 2 lots, one of which was churned in a box churn until the butter granules were about the size of clover seed, while the other lot was churned in a combined churn and worker until the butter granules were about the size of corn grains. Both lots were salted and worked to the same extent except that one was worked on a table worker and the other in the combined churn and worker. Eleven trials of this kind were made. The average water content of the butter churned to large granules was 13.89 per cent, and of the butter churned to small granules 12.15 per cent.

In 10 comparative tests granular butter was divided into 2 portions, one of which was worked in a combined churn and worker and the other on a table worker. The average water content of the butter worked by the 2 methods was, respectively, 13.09 and 13.31 per cent.

"These results give practically the same average percentage of water in the butter worked by the 2 methods, showing in connection with the above experiment that the size of the granules of butter when churning stops has more influence on the amount of water left in the finished butter than does either of these 2 methods of working the butter."

White spots on butter, E. H. FARRINGTON (*Wisconsin Sta. Rpt. 1899, pp. 118–120, fig. 2*).—Tests were made to demonstrate the cause of white crystals entirely unlike mottles or white curd spots appearing on the surface of butter, especially on prints or bricks of butter in a refrigerator. Two 1-pound bricks from the same churning were kept at 50° F. in glass jars, one of which contained about 1 in. of water and the other the same quantity of sulphuric acid. The butter was raised above the liquid in each case. In the dry atmosphere of the jar containing the sulphuric acid crystals began to form on the surface of the butter within a few hours and nearly covered it in a few days. In the moist atmosphere of the jar containing the water no crystals formed on the surface of the butter, which, however, was covered with drops of brine. A second trial at 70° F. gave the same results. "Such spots are not an indication of defective salt, that the workmanship is poor, or the butter bad; they simply show that the butter has been kept in a cold place which at the same time was so dry that the water of the brine evaporated, leaving the salt on the surface."

The action of proteolytic ferments on milk with special reference to galactase, the cheese-ripening enzym, S. M. BABCOCK, H. L. RUSSELL, ET AL. (*Wisconsin Sta. Rpt. 1899, pp. 157–174, figs. 11*).—In the investigations here reported, the object of which was the differentiation of galactase from trypsin and other ferments, quantitative determinations were made of the different decomposition products formed by various ferments in sterilized milk. The ferments used were the enzyms galactase, trypsin, pancreatin, pepsin, and rennin, and the bacteria *Bacillus subtilis*, 2 species isolated from imperfectly sterilized milk and designated *B.* 299 and *B.* 83, *B. acidi lactici* and *B. coli communis*. Samples of fresh separator milk which had been sterilized were inoculated with these ferments and incubated at 37 to 38° C., for periods ranging from 1 to 16 weeks. Two per cent of chloroform was added to the samples inoculated with enzyms to prevent the growth of any bacteria present through possible contamination. The chemical analyses, which were performed in two independent series, involved determinations of the albumins and casein (precipitated by heat and acetic acid), albumoses (precipitated by zinc sulphate), peptones (preciptated by tannic and phosphotungstic acids), amids (not precipitated by reagents), and ammonia. The analytical methods employed are briefly described, a detailed account being given in a separate article (see p. 19). The results in detail are given in tables and are also shown graphically in a series of diagrams.

The progressive formation of soluble nitrogenous products by galactase, trypsin, and pancreatin differentiated these enzyms from pepsin and rennin, digestion with the latter enzyms and with commercial rennet extract taking place only in milk acidified with 0.2 per cent hydrochloric acid. The action of *Bacillus subtilis*, *B. 299*, and *B. 83* as regards the conversion of nitrogen into soluble form was similar to that of galactase. The amount of soluble nitrogen was not increased by *B. acidi lactici* or *B. coli communis*. Proteolytic changes in all cases were more rapid in the earlier than in the later stages of digestion, from 30 to 85 per cent of the total nitrogen being digested during the first 7 days. A differentiation of the proteolytic ferments was also shown by the character of the decomposition products. No ammonia was produced by trypsin, pancreatin, and pepsin. In samples of milk acted upon by galactase, *Bacillus subtilis*, *B. 299*, and *B. 83* for 112 days the nitrogen in the form of ammonia was respectively 0.04, 0.21, 0.11, and 0.15 per cent. In cheese 120 days old the ammonia was 0.17 per cent. Tryptic digestion was more rapid than that of galactase. The absence therefore of ammonia, together with the total disappearance of albumoses, and the presence of large quantities of amids and peptones in digestion with trypsin, and the presence of both ammonia and albumoses in digestion with galactase at the end of 112 days strengthened the conclusion that these two enzyms are not identical, although allied in some of their properties. The relative quantities of different end products of digestion, especially amids and ammonia, differentiated galactase from the bacterial enzyms.

The relation of galactase to other enzyms is considered in connection with the cause of the changes taking place in the ripening of cheese. "The similarity of products formed in the normal ripening of Cheddar cheese with those produced by galactase where all other factors are controlled, shows beyond all question that the main causal agent in the proteolytic changes that occur in these cheeses is due to this enzym."

Influence of galactase in the ripening of cottage cheese, S. M. Babcock, H. L. Russell, and A. Vivian (*Wisconsin Sta. Rpt. 1899, pp. 175–178*).—Several experiments were made in a study of this question. In 2 experiments cottage cheese was made from normal milk, the acid being developed naturally by bacterial fermentation. In 1 of the experiments the curd was washed with warm water to remove as much acid as possible. In 2 other experiments cottage cheese was made from milk which had been heated to 192° F. for 20 minutes in order to destroy the inherent galactase. The acid was developed in one case by means of a buttermilk starter and in the other 0.5 per cent of commercial lactic acid was added. In each of the 4 experiments one portion of the curd was kept under chloroform. Determinations of the

total and soluble nitrogen at different periods during ripening are tabulated. The results are briefly discussed and the following conclusions are drawn:

"This series of experiments leads us to consider that the digestion of casein in cottage cheese is due, not so much to the action of vital ferments, in and on the curd masses as has hitherto been supposed, but to the effect of inherent milk enzyms, of which galactase is undoubtedly the most important. They also indicate that the lactic-acid group of bacteria have no appreciable effect on digestion.

"Furthermore, it is shown in these instances that the casein of milk, when precipitated by acid instead of rennet, undergoes a proteolytic or digestive change, in a manner comparable to that which occurs in normal milk."

Effect of digesting bacteria on cheese solids of milk, H. L. Russell and V. H. Bassett (*Wisconsin Sta. Rpt. 1899, pp. 187–193*). Experiments were conducted to determine if losses occurring in the manufacture of cheese from tainted milks are due to the digestion of the casein of the milk by bacteria. Samples of raw and sterile milk inoculated with pure cultures of various species of digesting and gas-producing bacteria were incubated for 14 to 24 hours at temperatures ranging from 82 to 99° F. Determinations of the soluble nitrogen and the total solids of the milk and whey at the beginning and end of the experiments are tabulated. The results are considered as showing that the casein of the milk suffers no appreciable loss through the action of digesting bacteria during the first 24 hours after milking.

"It is therefore fair to assume that the losses sustained are attributable, in the main, if not wholly, to the manufacturing methods that are used in the handling of such tainted milks. This being the case, it is possible that improvements may be made in these methods whereby some, at least, of these losses may be prevented, a condition which would not in any way be possible if the insoluble casein was dissolved by these digesting organisms during the period before the milk is ordinarily made into cheese.

"It is more than likely that the digesting microbes attack the albumen in milk first, and so have in this already soluble material sufficient food to sustain them for a considerable period. Later, the insoluble casein molecule is rendered soluble through the continued activity of this type of ferment action."

Notes upon dairying in California and the export of California butter to the Orient, R. A. Pearson (*U. S. Dept. Agr., Bureau of Animal Industry Bul. 24, pp. 29, pls. 4, fig. 1*). A brief account is given of the dairy exhibit at the California State fair, held at Sacramento September 4–16, 1899. Scores on the butter exhibited are tabulated. A résumé is given of the principal points brought out in a general discussion on the export of dairy products from the Pacific coast at a meeting of the California State Dairymen's Association, held at Sacramento during the fair. Among the phases of the subject discussed were causes affecting hardness of butter, making and packing butter for warm climates, and the use of preservatives. Some purposes of the experimental exports of butter to foreign markets by the Department are noted, and statistics are given of the exports of

butter and cheese from the United States to trans-Pacific countries from 1893 to 1899. The author discusses, with reference to conditions and practices observed in California, the use of sugar-beet pulp and sugar-beet tops for dairy cows, method of payment for milk at creameries, handling of milk from cows fed alfalfa hay, butter packages, cheese making, milk supply of cities, and dairy education in the State, offering suggestions for improvement along various lines.

The possibilities of dairying in Cuba, D. R. RANKIN (*Hoard's Dairyman, 31 (1900), No. 17, pp. 336, 337*).

Twelfth annual report of the dairy school at Rütti-Zollikofen, Bern, 1899 (*XII. Jahresbericht der Bernischen Molkereischule in Rütti-Zollikofen pro 1898–99. Bern, 1899, pp. 44*).

Summary of results of tests of new feeding stuffs at Poppelsdorf during the winter of 1898–99, E. RAMM (*Milch Ztg., 28 (1899), No. 52, pp. 817–819*).—This is a summary account with tabulated data of a series of feeding experiments with milch cows, previously reported in detail (E. S. R., 11, pp. 81, 86, 885), comparing peanut cake with the following feeding stuffs: Tropon residue, brewery residue (Brauerschlempe), Illipe cake, palm-nut cake and Illipe cake, Tropon, English cake (consisting mainly of cotton-seed meal and molasses), malt-sprouts-molasses, gluten meal, and raw sugar.

Tests of dairy cows, 1898–99, J. W. DECKER (*Wisconsin Sta. Rpt. 1899, pp. 140–152, fig. 1*).—Official tests were made by representatives of the station during the year of 73 Holstein cows for the Holstein-Friesian Association, 7 Brown Swiss cows for the Brown Swiss Cattle Breeders' Association, and 2 Guernsey cows for the American Guernsey Cattle Club. The manner of conducting the tests is described and the results are tabulated and discussed. In tests of 5 Holstein cows a record was also kept of the amount and cost of food eaten during the 7 days.

Scale of points in use in the United States for judging the dairy breeds of cattle (*U. S. Dept. Agr., Bureau of Animal Industry Circ. 27, pp. 16*).—Reprinted from the Annual Report of the Bureau of Animal Industry for 1898 (E. S. R., 11, p. 983).

Eccentricities of the cow, C. D. SMITH (*Farm Students' Rev., 5 (1900), No. 6, p. 85*).—Variations in the composition of milk during the same and succeeding periods of lactation are discussed.

Examination of milk for tubercle bacilli, V. H. BASSETT (*Wisconsin Sta. Rpt. 1899, p. 205*).—Thörner's method (E. S. R., 4, p. 214) was used in examining 4 samples of separator slime and 30 samples of milk coming from cows reacting to the tuberculin test.

"The result of these examinations showed that in no case were tubercle bacilli demonstrated in the milk from reacting cows that had no evident udder lesions of the disease. The accuracy of the method of examination is checked by the fact that in every instance where tuberculous sputum was added a positive microscopic result was noted."

Investigations on lactic acid fermentation and its practical use, S. EPSTEIN (*Arch. Hyg., 37 (1900), No. 4, pp. 329–359*).

Testing cream (*Hoard's Dairyman, 31 (1900), No. 18, p. 355*).—The use of the Babcock test in determining the fat content of cream is briefly discussed.

On the composition of Norwegian creamery butter, F. H. WERENSKIOLD (*Norsk Landmandsblad, 18 (1899), No. 50, pp. 607–611*).—Gives the results of periodical examinations of the butter from nine creameries during 1899. Determinations of specific gravity (at 100° C.), refractive index, and Reichert number were made.—F. W. WOLL.

Renovated butter and its identification, J. A. HUMMEL (*Farm Students' Rev., 5 (1900), No. 6, pp. 86, 87, figs. 3*).

Annual report of the experiment station for cheese making at Lodi, 1898 (*Ann. R. Staz. Sper. Caseif. Lodi, 1899, pp. 103*).—The lines of investigation reported upon include the manufacture of several kinds of cheese, the influence of light on the souring of milk, the yield of cheese as affected by the use of soluble lime salts, a chemical study of the alluvial soils of Lodi, and the composition of various flours used in bread making.

Cheese factories of Roquefort, F. DONATI (*Ind. Lait., 25 (1900), No. 20, pp. 153, 154*).—A descriptive account of the production of Roquefort cheese.

Coating cheese with paraffin to prevent mold, J. W. DECKER (*Wisconsin Sta. Rpt. 1899, pp. 153, 154, fig. 1*).—A number of trials of coating cheeses of different ages with paraffin were made by the author. When properly done the coating was a complete protection against the growth of mold. When the cheese was not carefully handled the paraffin would break away from the cheese and mold would grow beneath it. The coating of new cheese was thought to impair the flavor, while the coating of cheese 3 months old or older seemed to cause no injury in flavor. When cheese had been covered with a double bandage and paraffined, the outer bandage could be stripped off, leaving a fairly bright cheese. The cost of coating a 10-pound cheese was $\frac{7}{10}$ of a cent.

Examination of dairy salts, F. W. WOLL (*Wisconsin Sta. Rpt. 1899, pp. 108–117*).—A reprint of the main original data given in Bulletin 74 of the station (E. S. R., 11, p. 585).

Danish butter exports, 1898-99, B. BÖGGILD (*Tidsskr. Landökon., 1899, No. 12, pp. 540–548*).—The exports of butter during the year October 1, 1898, to September 30, 1899, were as follows: To England, 140,894,253 lbs.; to Germany, 2,811,887 lbs.; to other countries, 662,794 lbs.; total, 144,368,934 lbs. Danish (1 lb. Danish=1.1 lbs. avoirdupois). The imports during the same period aggregated 34,289,831 lbs., making the net exports 110,079,103 lbs. 16,752,853 lbs. of butter was imported from Sweden, and 15,170,051 lbs. from Russia (Finland). About 3,500,000 lbs. of the butter exported was canned. The average price received for the export butter during the year was 25.8 cts. per pound Danish (23.5 cents per pound avoirdupois).—F. W. WOLL.

Denmark's production of milk and butter, 1897, B. BÖGGILD (*Ugeskr. Landm., 45 (1899), No. 47, pp. 585–587*).—The author calculates on the basis of the latest official statistics that the total production of butter in Denmark in 1896 was about 129,030,000 lbs. Danish, and the total milk production, 4,502,780,000 lbs. The 1,145 cooperative and proprietary creameries in the country in 1897 made 116,126,000 lbs. butter and 19,048,000 lbs. (skim-milk) cheese, the average value received for the products at the factory being 23.9 cts. and 3.5 cts., respectively, per pound. The number of milch cows in the country, according to the census of 1898, was 1,067,138.—F. W. WOLL.

A new Belgian butyrometer, A. THEUNIS (*Ind. Lait., 25 (1900), Nos. 21, pp. 161, 162; 22, pp. 169–171, figs. 3; Rev. Gén. Agron., 9 (1900), No. 2, pp. 50–60, figs. 3*).—A new form of centrifugal fat tester devised by Mercier is figured and described. The test bottle is provided with a thistle tube through which the milk and the amyl alcohol and sulphuric acid used in the test are introduced. In comparison with the Gerber method the test gave closely corresponding results.

A composite milk-sampling pipette, J. W. DECKER (*Wisconsin Sta. Rpt. 1899, pp. 155, 156, fig. 1*).—A pipette designed by the author for taking composite milk samples is essentially a glass tube $\frac{1}{2}$ in. in diameter and about 12 in. long, graduated in $\frac{1}{4}$ in. spaces, the ends of the tube being somewhat constricted. In using the pipette a sample of milk is taken of as many spaces in the tube as there are pounds of milk to be sampled. The individual samples are then in proportion to the yields

of milk for the several milkings represented in the test. The average fat content of 10 composite samples, each representing 21 milkings during 7 days, taken in this way was 3.245 per cent, while the calculated average per cent was 3.27.

Officials, associations, and educational institutions connected with the dairy interests of the United States for the year 1900 (*U. S. Dept. Agr., Bureau of Animal Industry Circ. 29, pp. 9*).—A list of each.

VETERINARY SCIENCE AND PRACTICE.

Report of the cattle quarantines in Canada from November 1, 1897, to October 31, 1898, D. McEachran (*Ottawa: 1899, pp. 56*).—A report is given on the exportation and importation of animals and upon the diseases which were studied during the time covered by the report. These studies included work on tuberculosis, sporadic aphtha, a disease affecting the mouths and feet of cattle, resembling foot-and-mouth disease, Texas itch, hog cholera, swine plague, anthrax, glanders, actinomycosis, sheep scab, and enzootic ophthalmia in cattle and sheep.

The greater portion of the report is occupied with the report by J. G. Adami and C. F. Martin upon the cattle at the Experimental Farm at Outremont, Quebec, including studies upon the tuberculin test, the detection of tubercle bacilli in milk of suspected animals, the inoculation of guinea pigs and rabbits with milk from these animals, feeding calves with the milk of suspected animals, and a *post-mortem* examination of the cows. The results of these studies may be stated as follows: The 10 cows which reacted to the tuberculin test presented good evidences of tuberculosis upon *post-mortem* examination. The disease was not generalized in any of the cows, and there were only 4 cases of pulmonary lesions. Nine of the cows gave distinct evidence of the infection of the peri-tracheal lymph glands. In no case was there any infection of the mammary glands, although in one cow the supramammary lymph glands contained tubercles. It is possible that repeated large doses of tuberculin exercise a slight curative effect. Although the cows were free from tuberculosis of the udder the milk of several contained tubercle bacilli at times. Out of 44 guinea pigs and 42 rabbits inoculated with such milk only 2 guinea pigs and 1 rabbit died of generalized tuberculosis. Young calves fed entirely upon the milk of these infected cows for a period of several months remained wholly free from the disease, did not react to tuberculin, and showed no trace of tuberculosis upon *post-mortem*.

During the experimental period, the number of tubercle bacilli present in the milk increased greatly at times without any obvious cause. And it is therefore evident that the milk of such cows although usually not infectious may become so at any time.

Effect of different influences on normal temperatures of cattle and relation of same to tuberculin test, H. L. Russell and V. H.

BASSETT (*Wisconsin Sta. Rpt. 1899, pp. 194–204*).—The authors conducted experiments for the purpose of determining the effect of ingestion of cold water upon the temperature of cattle. In a herd of 45 cows, 39 were allowed to remain out of doors for from 20 to 60 minutes where they had access to cold water. The other 6 cows of the herd were kept in the barn and were not watered. The cows were watered at 9 a. m. At 10 a. m. the average temperature of the cows which were watered was 100.19° F., and the average temperature of the cows which were not watered was 102.12° F. The average difference in temperature before and after watering was 2.17°, a fall of temperature being noticed in every case except two. The individual variation ranged from 0.9 to 5.1°. In order to determine the influence of the size of the animal upon the fall of temperature after drinking cold water, the herd was divided into 2 sections, the one composed of animals weighing 900 lbs. or more and the other of animals weighing less than 900 lbs. The average fall of temperature after watering in the first section was 2.02° and in the second section 2.3°.

An experiment was conducted with 15 cows for the purpose of determining whether the observed fall in temperature after watering could be attributed to exposure to the cold outside atmosphere. Eight of these 15 cows were watered in the barn and 7 were watered out of doors, the temperature of water in both cases being the same. The average fall of temperature in the cows which were watered in the barn was 1.66° and of those which were watered out of doors, 1.5°. It appears from this experiment that the fall in temperature is to be attributed solely to the ingestion of cold water.

In order to approach the problem from another side, an experiment was conducted in watering cows with water heated to a temperature of 101° F. The results showed that the variation in temperature after drinking this water was practically nothing. It is thus apparent that the ingestion of a large quantity of cold water during the reaction fever to the tuberculin test might lower the temperature of the animal to such an extent as to obscure the reaction and lead to a faulty diagnosis.

Experiments were conducted for the purpose of determining what influence, if any, thirst has upon the temperature of cattle. Observations on this point were made both in the winter and summer. The animals were allowed to thirst for 24 hours and their temperatures were then taken. The variation in temperature was so slight that it could be safely neglected in making tuberculin tests. Œstrum and parturition were observed to have only a very slight effect in elevating the temperature of cows. Dehorning caused a general rise in temperature in all the animals observed.

The general results of these experiments may be stated as follows: The ingestion of large quantities of cold water may produce a marked

fall in temperature. Where, however, the water is given frequently and in small quantities, the accuracy of the tuberculin test would probably not be affected. The observations which were made by the authors indicate that parturition, advanced gestation, and œstrum produce very slight fluctuations in temperature. The internal physiological conditions of the animals seem, therefore, to have less influence upon the temperature of the animal than external conditions.

The effects of eating moldy corn, A. W. BITTING (*Indiana Sta. Rpt. 1899, pp. 44, 45*).—A study of samples of moldy corn from different sources disclosed the presence of 3 organisms—1 bacterial organism and 2 molds.

Two horses were used for inoculation experiments, each receiving 5 cc. of an active growth of the bacteria hypodermically, and after 36 hours 10 cc. more. No pathological effects were produced. All 3 of the organisms were cultivated upon sterilized corn meal, which was then fed to the horses as a mash. The bacterial organism and one of the molds produced no effects. The other mold, a species of Fusarium, produced redness of the gums and some salivation. The animals had eaten about 5 lbs. per day for 5 days. On the fifth day one of the horses showed occasional pains and diarrhea. On the seventh day there were some muscular incoordination and stupor. The second horse exhibited some irritation of the mucus membranes of the mouth, but did not develop any nervous symptoms. The 2 horses together ate about 4 bu. of the moldy corn.

An experimental investigation of a dermatomycosis of fowls, L. MATRUCHOT and C. DASSONVILLE (*Rev. Gén. Bot., 11 (1899), No. 132, pp. 429–444, pls. 2*).—The authors conclude from a study of this disease that the dermatomycosis, which heretofore has been called favus of fowls, and white comb, a comb disease, is quite distinct from favus and should be called by a special name. The organism which causes the disease is *Lophophyton gallinæ*. The disease occurs spontaneously among gallinaceous birds, but not among mammals, and is quite different from the dermatomycosis of the hair of mammals. The organism of this disease produces only superficial lesions and in this respect is also different from favus. The organism in the lesions is characterized by a persistent mycelium of short joints of 3 to 4 cells. In cultures no lateral chlamydospores appear. As regards the systematic position of *Lophophyton gallinæ*, it seems to stand near the Gymnœcia.

The science of operations (Operationslehre), J. BAYER (*Vienna and Leipsic: W. Braumüller, 1899, pp. 522, figs. 451*).—This constitutes volume 1 of a handbook of veterinary surgery and obstetrics and presents a general discussion of surgical methods together with descriptions of the special technique of various operations.

The defense of the organism against the morbific properties of the glandular secretions, CHARRIN and LEVADITI (*Compt. Rend. Soc. Biol. Paris, 52*

(*1900*), *No. 4, pp. 83–86*).—The author's investigations indicate that the organism is protected against injurious properties of certain digestive secretions, especially the pancreatic juice, by substances which appear to be produced by the epithelial cells of the ileum.

Subcutaneous injections, F. ESCHBAUM (*Berlin. Tierärztl. Wchnschr., 1900, No. 4, pp. 39–41*).—The author believes that the hypodermic injection syringe should be constructed with 2 or 3 rulings measured with special care, in order that the size of the dose may be accurately known. It is necessary to take into account the specific weight of the substances which are to be used in these syringes. The author recommends State inspection of hypodermic syringes.

Tuberculosis, MCFADYEAN (*Dairy, 12* (*1900*), *No. 134, p. 40*).—Notes on the means of distribution of tuberculosis with special reference to tuberculosis of the udder.

On the frequency of tuberculosis, GUTBROD (*Wchnschr. Tierheilk. u. Viehzucht, 44* (*1900*), *No. 5, pp. 41–43*).—Statistics of tuberculosis as found in slaughterhouses and an account of tuberculin tests in suspected cases.

Failures in the diagnosis by means of tuberculin, SWICKER (*Berlin Tierärztl. Wchnschr., 1900, No. 5, pp. 52–54*).—The author believes that a considerable proportion of the causes of alleged failure of tuberculin is due to simple carelessness in labeling the animals during the tuberculin test. Where the test is applied simultaneously to a large number of cattle, the greatest care must be exercised to prevent mistakes in the identity of the records before and after injection.

Letters relating to the distribution of vaccine (*U. S. Dept. Agr., Bureau of Animal Industry Circ. 28, pp. 9*).—This circular contains a copy of a letter of the Secretary of Agriculture to Mr. H. R. Strong, a letter of Parke, Davis & Co. to the Hon. Jas. McMillan, a letter of the Secretary of Agriculture in reply to this last-named letter, and a letter from the H. K. Mulford Company to the Secretary of Agriculture, together with a reply to the same. These letters have to do with the question of the free distribution of vaccine by the Bureau of Animal Industry.

Pseudoscabies, A. W. BITTING (*Indiana Sta. Rpt. 1899, pp. 43, 44*).—Upon investigating an alleged outbreak of sheep scab, it was found that the trouble was due to the awns of *Stipa spartea*. These awns had evidently penetrated the skin of the sheep in the Southwestern States, from which they had been imported.

The so-called air-bladder mesentery of swine, SCHMUTZER (*Ztschr. Fleisch u. Milchhyg., 10* (*1900*), *No. 5, pp. 89–95*).—The author discusses the well-known appearance of small air bladders in the mesentery, especially of the small intestine in healthy pigs. From a careful study of a large number of cases, the author concludes that the gas contained in these bladders is not the product of micro-organisms and does not come from the intestine, but that it comes from the outside air.

Glanders and the sanitary law, O. LEBRUN (*Rec. Méd. Vét. Paris, 8. ser., 7* (*1900*), *No. 1, pp. 32, 33*).

The diagnostic value of mallein, E. ISEPPONI (*Schweiz. Arch. Thierh., 42* (*1900*), *No. 1, pp. 1–20*).—In a drove of 60 horses, 2 were suspected of having glanders, and mallein tests were given to these horses. The *post-mortem* examinations in these two cases furnished confirmation of the reaction which was obtained by the use of mallein. Mallein tests were made upon a number of other horses, and the details of the temperature conditions are given.

The author concludes that glanders often exists in a hidden form and that, therefore, mallein is a necessary agent in the eradication of the disease from a drove of horses. It is recommended that mallein tests be given at once to suspected horses, and that such as fail to react should be at once removed from quarantine.

The reliability of the Strauss method, C. TROESTER (*Ztschr. Veterinärk., 12* (*1900*), *No. 2, pp. 69, 70*).—As a result of considerable experience in diagnosing suspected cases of glanders, the author states that the Strauss method of inoculating male guinea pigs is perhaps the most reliable one for making correct diagnoses.

In order that this method may give the best results, however, it is necessary to make inoculations with material as fresh as possible. The glanders bacillus soon loses its vitality in material which is kept about the laboratory.

Statistical notes on periodical ophthalmia of horses, I. SHULZHENKO (*Arch. Vet. Nauk, St. Petersburg, 29 (1899), No. 12, II, pp. 570–583*).—Tabulated statements with a discussion on the frequency of this disease in different governments of Russia.

Composition of bones of sound horse and of bones of horse suffering with osteoperosis, H. H. HUSTON and A. H. BRYAN (*Indiana Sta. Rpt. 1899, pp. 73, 74*).—The humerus of each animal was taken for analysis. The bone of the normal horse was yellowish, while that of the diseased animal was gray and brittle. In the diseased horse a small gain of ossein was noticed. The most conspicuous changes in the bone of the horse suffering with osteoperosis were a reduction in the amounts of fat, phosphoric acid, lime, soda, and nitrogen-free organic matter.

Material for packing horses' hoofs, H. A. HUSTON and A. H. BRYAN (*Indiana Sta. Rpt. 1899, p. 72*).—A table is given showing the composition of substances to be used for this purpose.

On pseudotuberculosis, with special reference to pseudotuberculosis in birds, R. MUIR (*Jour. Path. and Bact., 5 (1898), No. 2, pp. 160–181, pls. 2*).—The author conducted feeding experiments with guinea pigs. The article contains a discussion of the literature of the subject, with a bibliography.

AGRICULTURAL ENGINEERING.

Description of experiment station piggery, H. E. VAN NORMAN (*Indiana Sta. Rpt. 1899, pp. 140–143, pl. 1, fig. 1*).—The building is described and a general view and floor plan are given. The main part of the building is 22 by 46 ft. outside. On each side is a wing 12 by 14 ft. The front part only of the main building, 22 by 32 ft., is two stories high. The first floor contains 8 feeding pens, 4 of which communicate with sleeping pens in the wings of the building. The remainder of the floor space is occupied by a brood-sow pen, storage and attendant's room, scales, mixing vats, feed chutes, water hydrant, etc. The upper story of the building affords storage room for bedding, crates, and bin room for feed. "The building is so placed as to be centrally located among a series of feeding lots, all of which are connected to the building by lanes leading up to it. Each lot contains a small house for sleeping quarters."

Irrigation, L. JASTREMSKI (*Louisiana Planter, 24 (1900), No. 25, pp. 394–397*).—A paper read before the Central Louisiana Agricultural Society.

An electric-recording river gauge, W. M. FULTON (*Univ. Tennessee Record, 1899, No. 11, pp. 232–243, fig. 7*).—This is a description of a river gauge devised by A. Wade in the mechanical shops of the University of Tennessee.

Petroleum motors and their employment in agriculture, R. GAGEY (*Bul. Dir. Agr. et Com., 5 (1900), No. 15, pp. 63–81, fig. 3*).

Tests of manure spreaders, BRUTSCHKE (*Mitt. Deut. Landw. Gesell., 15 (1900), No. 15, pp. 101, 102*).

STATISTICS—MISCELLANEOUS.

Twelfth Annual Report of Alabama College Station, 1899 (*Alabama Sta. Rpt. 1899, pp. 32*).—This contains the organization list of the station; report of the treasurer for the fiscal year ended June 30, 1899; and reports of the director and botanist, chemist, associate chemist, veterinarian, agriculturist, and biologist and horticulturist, giving a general review of the station work during the year ended December 31, 1899. The report of the director contains in addition a summary of the contents of Bulletins 101–107 of the station, a list of bulletins now available for distribution, an exchange list of periodicals received at the station library, a list of seeds of trees furnished by this Department, and notes on the exhibit of cotton prepared by the station for the Paris Exposition.

Twelfth Annual Report of Georgia Station, 1899 (*Georgia Sta. Rpt. 1899, pp. 111–145*).—This embraces a brief account of the organization and work of the station during the year, a financial statement for the fiscal year ended June 30, 1899, and a report of the biologist and horticulturist containing an account of work with plums, grapes, and vegetables, and notes on plant diseases and insects.

Twelfth Annual Report of Illinois Station, 1899 (*Illinois Sta. Rpt. 1899, pp. 16*).—This includes a brief statement of the principal lines of station work, subject list of bulletins published since 1888, a detailed financial statement for the fiscal year ended June 30, 1899, and the organization list of the station.

Twelfth Annual Report of Indiana Station, 1899 (*Indiana Sta. Rpt. 1899, pp. 150*).—This includes the organization list of the station; a report by the director on the station work, staff, publications, and mailing list; miscellaneous articles noted elsewhere; acknowledgments; list of periodicals received at the station; and a financial statement for the fiscal year ended June 30, 1899.

Biennial Report of Iowa Station, 1898–99 (*Iowa Sta. Rpt. 1898–99, pp. 33–37, 77, 78*).—Notes on the work of the station, abstracts of Bulletins 37–43 of the station, and a financial statement for the fiscal year ended June 30, 1899, are included in these pages.

Seventeenth Annual Report of New York State Station, 1898 (*New York State Sta. Rpt. 1898, pp. 598*).—This contains the organization list of the station, the report of the treasurer for the year ended September 30, 1898, a meteorological record for the year, reprint of a station circular on the name of a new variety of cherry, and reprints of Bulletins 143–157 on the following subjects: Cottonwood-leaf beetle; green arsenite (E. S. R., 10, p. 467); a spraying mixture for cauliflower and cabbage worms (E. S. R., 10, p. 869); report of analyses of commercial fertilizers for the spring of 1898 (E. S. R., 10, p. 833); some experiments in forcing head lettuce (E. S. R., 10, p. 957); variety tests of strawberries, raspberries, and blackberries (E. S. R., 10, p. 961); report of analyses of commercial fertilizers for the fall of 1898 (E. S. R., 10, p. 1033); the economy of using animal food in poultry feeding (E. S. R., 11, p. 76); the raspberry sawfly, and preliminary notes on the grapevine flea-beetle (E. S. R., 11, p. 63); experiments in ringing grapevines (E. S. R., 11, p. 49); two destructive orchard insects (E. S. R., 11, p. 170); director's report for 1898 (E. S. R., 11, p. 295); commercial fertilizers for potatoes, II (E. S. R., 11, p. 235); sugar-beet investigations in 1898 (E. S. R., 11, p. 238); spraying cucumbers in the season of 1898 (E. S. R., 11, p. 257); and self-fertility of the grape (E. S. R., 11, p. 248).

Annual Report of South Carolina Station, 1899 (*South Carolina Sta. Rpt. 1899, pp. 37*).—This includes a general report on the work of the station by the vice director and more detailed reports by the agriculturist, chemist, botanist, veterinarian, horticulturist, entomologist, and assistant agriculturist. The departmental reports give in some cases brief statements of the results obtained during the year. A financial statement for the fiscal year ended June 30, 1899, and a subject list of station publications are appended.

Sixteenth Annual Report of Wisconsin Station, 1899 (*Wisconsin Sta. Rpt. 1899, pp. 332, figs. 79*).—This includes the organization list of the station, a detailed account of the history and present status of the station, numerous articles noted elsewhere, lists of exchanges and acknowledgments, and a financial statement for the fiscal year ended June 30, 1899.

Distribution of the agricultural exports of the United States, 1894–1898, F. H. HITCHCOCK (*U. S. Dept. Agr., Section of Foreign Markets Bul. 16, pp. 153*).—Statistical tables are given showing the quantities and values of all the various agricultural products exported from the United States to each country of destination during each of the 5 fiscal years 1894–1898. A summary is given showing the total values of agricultural exports by countries. The average annual value of the agricultural exports during the 5 years was $663,536,201. The United Kingdom received 54.62, Germany 13.01, and France 6.63 per cent of the total exports. The United Kingdom also showed the greatest increase during the 5 years. A marked falling off in demands for American agricultural products was shown in case of Spain, Portugal, and European Russia. A summary of the distribution of agricultural exports by continents showed that Europe received 88.46 per cent.

Sources of the agricultural imports of the United States, 1894–1898, F. H. HITCHCOCK (*U. S. Dept. Agr., Section of Foreign Markets Bul. 17, pp. 118*).—This is supplementary to Bulletin 16 of the Section (see above) and contains tables showing in detail the quantities and values of all the agricultural products imported into the United States from the several countries of supply during each of the 5 fiscal years 1894–1898. The average annual value of the agricultural imports during the 5 years was $368,748,457. The articles most extensively imported were sugar and coffee. Of the total imports 16.17 per cent was supplied by Brazil, 10.14 by Cuba, and 8.97 by the United Kingdom. The imports from Japan, China, and the Hawaiian Islands showed the greatest increase and those from Cuba the most marked decrease during the 5 years. A classification of the agricultural imports by continents showed that about 30 per cent came from Europe, 23 per cent from South America, 23 per cent from North America, 16 per cent from Asia, 5.5 per cent from Oceania, and less than 2 per cent from Africa.

Our trade with Japan, China, and Hongkong, 1889–1899, F. H. HITCHCOCK (*U. S. Dept. Agr., Section of Foreign Markets Bul. 18, pp. 168*).—Tables show the nature, quantity, and value of agricultural and nonagricultural products imported and exported by the United States in the trade with Japan, China, and Hongkong. The principal exports from the United States to these 3 destinations have been cotton, cotton manufactures, kerosene oil, wheat flour, and manufactures of iron and steel. These constituted nearly 80 per cent of the total exports in 1898. Silk and tea formed about 70 per cent of the total imports in 1898. The total value of exports have advanced from $11,097,497 in 1889 to $39,490,653 in 1899, and the total value of imports from $35,196,670 in 1889 to $47,815,035 in 1899.

Agriculture and animal husbandry in Denmark, Germany, and Great Britain, G. VON ZWEIGBERGK (*K. Landt. Akad. Handl., 38 (1899), No. 5–6, pp. 261–343*).—A report on the characteristic features of agriculture, with special reference to animal husbandry in the countries mentioned. The paper is accompanied by numerous half-tone reproductions of noted farm animals of different breeds.—F. W. WOLL.

NOTES.

COLORADO COLLEGE AND STATION.—J. D. Stannard, assistant in the department of civil engineering, has severed his connection with the institution to accept a position in the irrigation investigations conducted by this Office. J. A. Stump has been appointed his successor, and the duties assigned to him will be principally in connection with the college. B. C. Buffum, formerly professor of agriculture and horticulture at the Wyoming Experiment Station, has been elected professor of agriculture and agriculturist of the experiment station. He will begin his duties September 1. Miss Virginia Corbett, of the Montana Agricultural College, has been elected professor of English literature, to succeed Miss Jennie E. McLain. C. S. Crandall, who has been botanist and horticulturist of the station since 1890, resigned that position July 1 to enter the service of the Division of Forestry of the U. S. Department of Agriculture. Mr. J. H. Cowen, a graduate of the Colorado Agricultural College and for several years botanist and horticulturist, was appointed to succeed him. Mr. Cowen's sudden death at Ithaca, N. Y., is just announced. The station has begun the publication of press bulletins, which will be distributed to papers in the State and to a limited number of individuals. The mailing list of the station is being revised so as to give more attention to the needs of individuals and exchanges. Field work was carried on during the summer in irrigation and other related questions; also investigations on injurious insects and the adaptability of grains to high altitudes.

NEBRASKA STATION.—W. D. Hunter resigned his position as assistant entomologist July 1 to accept a similar position with the experiment station at Ames, Iowa.

NEW MEXICO COLLEGE AND STATION.—W. M. Reed has been appointed engineer of the station and professor of civil and irrigation engineering in the college. Fabian Garcia, formerly assistant in the department of agriculture and horticulture, has been made horticulturist of the station and assistant professor of horticulture in the college. R. F. Hare, first assistant chemist of the station and instructor in the college, has been promoted to the assistant professorship of chemistry in the college. J. J. Vernon has been recently appointed agriculturist. A small herd of well-selected cattle has been purchased, and in the future animal husbandry will be made an important part of the work of the college and station. T. D. A. Cockerell has resigned his professorship in the college to accept the chair of biology in the New Mexico Normal University at Las Vegas. His services are retained as consulting entomologist of the station. E. O. Wooten, botanist of the station, will henceforth have charge of all the biological work of the college. The agricultural course in the college has been greatly strengthened, and it is thought in the future will be one of the best proportioned and strongest courses offered in the agricultural colleges of the country. In addition to his duties as soil physicist and meteorologist, J. D. Tinsley will superintend the Roswell Substation, where drainage problems will have special importance.

TENNESSEE COLLEGE AND STATION.—The designs for the new dairy hall, mention of which was made in E. S. R. 11, p. 800, have been enlarged so that with its equipment it will cost something more than $10,000. On the plats of the station favorable results have been secured with Canadian field peas and with rape. The experiments

with wheat, which have been conducted at the station, have proved very satisfactory, and the possibility of growing winter cereals seems well established.

TEXAS COLLEGE AND STATION.—At the annual meeting of the board of directors, July 6, P. S. Tilson, associate in chemistry, was relieved from duty in connection with the station, in order that he might devote his entire time to State fertilizer and college work. A station council has been provided for, to consist of the director, president, and chemist, with duties as yet undefined. The position of farm superintendent has been created in order that the care for the live-stock interests and field crops might be removed from the agriculturist and director. The determination of the exact duties of the position, together with a selection of a candidate, were assigned to a committee which has not yet made a report. This action has caused the name of H. C. Kyle to be dropped from the station rolls as foreman of the farm. The Texas Farmers' Congress held its third annual session at this place July 3–6, with 400 people in attendance. The proceedings will be published and distributed among the farmers, stockmen, and horticulturists of the State. The State Truck Growers' Association, State Floral Society, Central Texas Beekeepers' Association, and Texas Poultry and Pet Stock Association have become affiliated with the congress, and each is represented by a member on the general committee. The congress enthusiastically commends the work done on the several farms in connection with the station and college.

MISCELLANEOUS.—F. B. Smith, professor of agriculture in Wye College, England, is visiting this country for the purpose of making a study of the agricultural experiment station system and of seeing the various typical farm sections. He expects to visit a number of experiment stations before returning to England. A week was spent by him at the Department of Agriculture in familiarizing himself with the work of the different bureaus, divisions, and sections.

The Franklin Institute, of Philadelphia, has awarded the Elliott Cresson medal to Profs. W. O. Atwater and E. B. Rosa for their respiration calorimeter.

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EXPERIMENT STATION RECORD.

Editor: E. W. ALLEN, Ph. D., *Assistant Director.*

EDITORIAL DEPARTMENTS.

Chemistry, Dairy Farming, and Dairying—The Editor and H. W. Lawson.
Meteorology, Fertilizers and Soils (including methods of analysis), and Agricultural Engineering—W. H. Beal.
Botany and Diseases of Plants—Walter H. Evans, Ph. D.
Foods and Animal Production—C. F. Langworthy, Ph. D.
Field Crops—J. I. Schulte.[1]
Entomology and Veterinary Science—E. V. Wilcox, Ph. D.
Horticulture—C. B. Smith and V. A. Clark.
With the cooperation of the scientific divisions of the Department and the Abstract Committee of the Association of Official Agricultural Chemists.

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SUBJECT LIST OF ABSTRACTS.

CHEMISTRY.

BOTANY.

[1] Absent on leave.

LIST OF PUBLICATIONS ABSTRACTED.

ILLUSTRATIONS.

EXPERIMENT STATION RECORD.

Vol. XII. No. 2.

The International Congress of Experiment Stations, held in Paris in connection with the exposition, was the third of its kind, although less of international interest has attached to the two previous ones. All three of these international congresses have been held at or near Paris. The first convened at Versailles, in June, 1881, following the marked activity in the organization of experiment stations which occurred throughout Europe a few years previous to that time. The second congress was held at Paris in connection with the Universal Exposition of 1889. The third, which in point of attendance at least was to a greater extent international than the two preceding, met June 18 to 22, 1900. Seventeen countries in which experiment stations are maintained were represented by delegates, although in some cases the representation was smaller than would have been expected. No delegates were present from Russia, Norway, Sweden, Spain, or Canada. The enrolled membership was nearly two hundred, of whom sixty were directors of stations. Only accredited delegates were admitted to the congress, and cards of admission were issued upon registration.

The congress was presided over by Casimir-Perier, president of the *Société nationale d'encouragement à l'agriculture*, whose linguistic attainments specially fitted him for the position. The secretary of the congress was Louis Grandeau, director of the *Station agronomique de l'Est*. After an opening address by the president, M. Grandeau addressed the congress upon the history and development of the experiment station idea throughout the world. He gave particular attention to the stations of the United States, and highly commended their scope, facilities, and the character of their work. The provisional programme which had been sent out early in the year was then presented. The first day's sessions were taken up with the reading and discussion of papers relating to soils, fertilizers, and field tests. The sessions of the second day were occupied with papers on feeding animals, analyses of wine, cider, dairy products, seeds, etc. The closing session was devoted principally to questions of station organization and methods of investigation. The desirability of uniformity in methods of analysis, and where practicable in agricultural investigation, formed a quite prominent feature of the discussion, and upon the recommendation of the directory a resolution was introduced, which was

unanimously adopted, looking to the establishment of an international commission to secure uniformity of methods of investigation in all the experiment stations of the world. The plan of organization of this commission will be announced later.

The desirability of international methods is thoroughly appreciated in this country, where for a number of years past the Association of Official Agricultural Chemists has used its efforts to that end. Some success has followed the attempts to secure international cooperation in testing the methods adopted by the Association and those in use in foreign countries, but it has been impossible to get the work upon a satisfactory basis or make it official in an international sense. The establishment of a commission for this purpose will accordingly meet with approval in this country, and if it fulfills its mission this will be an important outcome of the congress.

The experiment station congress was preceded by the International Congress of Agricultural Instruction under the same presidency, with M. Lagorsse as secretary. In many instances the same delegates represented their countries at both conferences. The topic given principal consideration at the Congress of Agricultural Instruction was the teaching of agriculture in France, and the congress adopted resolutions looking to the better organization and coordination of agricultural education in the various sections of the country.

The two congresses were terminated by a banquet at Hotel Continental on the evening of June 21, at which about 150 persons were present. Several excursions were arranged for the benefit and pleasure of those in attendance at the congresses, and visits were paid to the laboratory of the *Compagnie générale des voitures*, where extensive experiments have for years been conducted upon the feeding of horses, to the experimental fields of the *Station agronomique de l'Est* at *Parc des princes*, and to the *Institut national agronomique*, where the various laboratories were inspected.

NEW AGRICULTURAL BUILDING AT KANSAS STATE AGRICULTURAL COLLEGE.

Agricultural Hall, the new agricultural building recently completed at the Kansas State Agricultural College, is a handsome structure of white Manhattan limestone, 90 by 95 feet. (Fig. 1.) It contains two stories and a basement, and cost, with equipment, $31,000. It stands

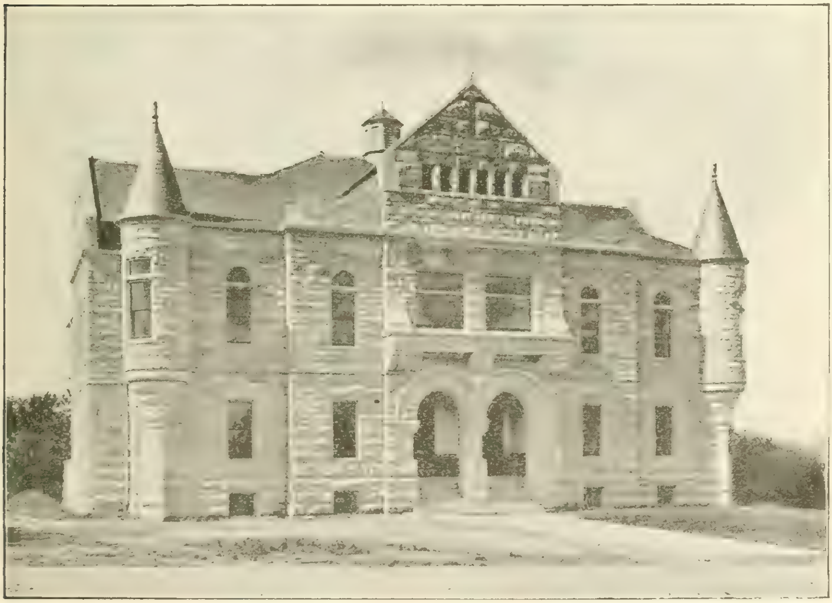

FIG. 1.—Agricultural Hall, Kansas State Agricultural College.

upon the former site of the president's residence, which was destroyed in 1895.

The first floor contains two good-sized offices, an agricultural library, cheese room, milk room, butter room, testing room, and cold-storage rooms. (Fig. 2.) The sides and ceilings of all the working rooms on this floor are covered with white opalite tiling, and the floors are laid with monolith tiling. The opalite tiling is made of tempered glass.

and is much cheaper than the ordinary porcelain tiling. If it proves satisfactory in the dairy rooms of this building, it is cheap enough for general use in creameries.

The second story contains three large lecture rooms for agricultural classes, two offices for instructors, and a cloak room. (Fig. 3.) The largest of the lecture rooms has a seating capacity of about 200, and may be used for institutes or other agricultural meetings.

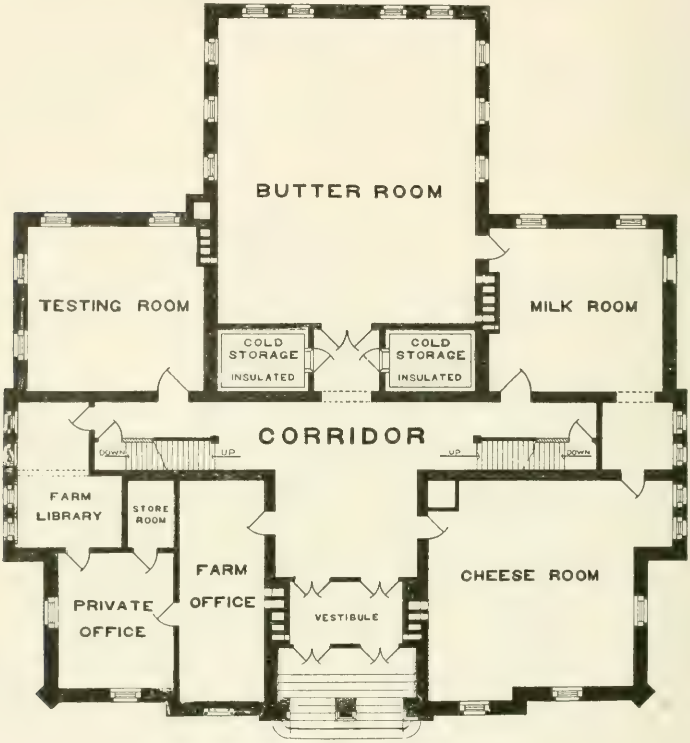

FIG. 2.—Plan of first floor, Agricultural Hall.

The basement contains a boiler room, engine and refrigerating room, lavatories and bathrooms, three insulated cheese cellars, and a large storage room. The refrigerating apparatus is planned to be available in all workrooms, in the cold-storage rooms, and in the cheese cellars, the arrangement in the cheese cellars being designed to maintain any degree of temperature at will.

All the workrooms are furnished with hot and cold water and steam, and the entire building is lighted by electricity. Power is supplied both by electric motor and steam. The refrigerating plant has not yet

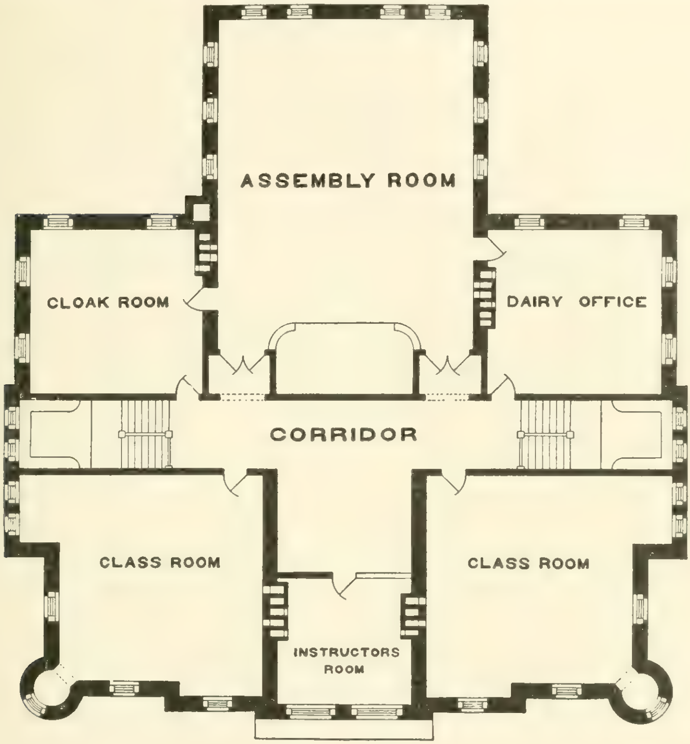

FIG. 3.—Plan of second floor, Agricultural Hall.

been installed, on account of lack of funds. With this exception the building is equipped with all the modern apparatus for factory and farm butter making, cheese making, testing and handling milk.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

New method for the gravimetric determination of reducing sugars, based upon the use of the centrifuge, P. Chapelle (*Rev. Chim. Analyt. et Appl., 5 (1900), No. 2, pp. 41-44*).—It is stated that the quantity of oxid of copper precipitated by Fehling's solution is not exactly proportional to the sugar used, but is a function of the dilution of the solution and excess of copper. When working with constant dilution, the only cause of trouble is the excess of copper, and it is easy to determine the value of that. A measured quantity of sugar solution insufficient to obtain complete reduction and 25 cc. of Fehling's solution are used. The total volume is then made up to 37½ cc.

The tubes containing the mixed solution are heated for 3 or 4 minutes in a calcium chlorid bath at 108 to 110°. They are then whirled in a centrifuge, and the copper adheres to the sides. The liquid is decanted and the copper precipitate washed with water, dried and weighed. It is stated that when 250 mg. of copper precipitate are obtained duplicates agree within ½ mg. A table is given, showing the amounts of glucose, lactose, sucrose, etc., corresponding to different weights of cuprous oxid.

In the succeeding number of the journal (No. 3) the application of this method to the determination of the sugars in milk, blood, wine, urine, etc., is considered.—H. SNYDER.

Simple and rapid method for the determination of the iodin number of fats, J. Bellier (*Rev. Chim. Analyt. et Appl., 5 (1900), No. 4, pp. 128-134*).—Hübl's method is considered as requiring too much time. The attempts to simplify the method by Wys and others are noted. The author uses a solution containing both iodin and bromin dissolved in acetic acid; 50 gm. of iodin and 32 gm. of bromin are dissolved in 950 cc. of acetic acid. The solvent for the fatty body is composed of chloroform, mercuric chlorid, acetic acid, and potassium iodid. One gram of material is dissolved and the bromin-iodin solution added until a permanent coloration for 5 minutes is secured, and the number of cc. of solution used gives directly the iodin number. It is claimed that the results obtained are practically the same as those by the Hübl method. The iodin number of a few oils as obtained by this method is given.—H. SNYDER.

The determination of glycogen, and relative quantities of glycogen in different parts of the flesh of a horse, J. K. HAYWOOD (*Jour. Amer. Chem. Soc., 22 (1900), No. 2, pp. 85–93*).—After testing a number of different methods for glycogen the author worked out the following, which is a modification of the Brücke method: From 50 to 60 gm. of ground meat is treated with 300 cc. of 1 per cent potassium hydroxid and heated on a steam bath for about 6 hours, water being added from time to time. The solution is evaporated to about 150 cc., made slightly acid with hydrochloric acid, and hydrochloric acid and double iodid of potassium and mercury added alternately until all proteid matter is precipitated. The solution is made to a volume of 500 cc. and an aliquot filtered and exactly neutralized with concentrated potassium hydroxid. Three or four drops of concentrated hydrochloric acid is added and twice the volume of 93 to 95 per cent alcohol, the precipitated glycogen filtered off after standing 2 or 3 hours, washed with alcohol and ether, dried at 80 to 100° C., then at 115° C., and weighed. After weighing, the filter is thoroughly extracted with boiling water, dried at 115° C., and again weighed, the difference in weight representing glycogen.

The author believes the method to be an improvement over the original Brücke method and sufficiently accurate for distinguishing horse meat from other meats.

Analyses are given of the chuck, rib, and flank of 3 different horses, and of the different cuts of meat from another horse.

The oxid of iron and alumina in mineral phosphates and superphosphates, MORIMONT (*Bul. Assoc. Belge Chim., 14 (1900), No. 1, pp. 16–18*).—Known amounts of iron and alumina oxids, when present in superphosphates, were determined by the method based upon Kroker's reaction (insolubility of iron and aluminium phosphates in acetic acid). The amount found exceeded the calculated and known amounts. It was the opinion of the author that the difference was caused by the presence of large amounts of lime.—H. SNYDER.

Résumé of the most important investigations in sugar chemistry during the last half of the year 1899 (*Deut. Zuckerind., 25 (1900), No. 5, pp. 177–181*).

A new gravimetric method of determining reducing sugars, CHAPELLE (*Jour. Pharm. et Chim., 6. ser., 10 (1899), No. 9, pp. 395–398*).

Weighing the precipitated cuprous oxid as cupric oxid in the gravimetric examination of sugar, F. BOLM (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 9, pp. 689–692*).

The determination of sugar in beets, J. WEISBERG (*Bul. Assoc. Chim. Sucr. et Distill., 17 (1899), No. 3, pp. 237, 238, fig. 1*).

Observations on the electrolysis of cane-sugar solutions, K. ULSCH (*Ztschr. Electrochem., 5 (1900), p. 539; abs. in Jour. Phys. Chem., 4 (1900), No. 2, p. 157*).

Analyses of sugar-cane molasses and various products in the manufacture of sugar from cane, H. PELLET (*Sucr. Indig. et Coloniale, 55 (1900), No. 9, pp. 275–278*).

The analysis of golden sirup, N. LEONARD (*Analyst, 25 (1900), Apr., pp. 85–87*).—A controversial article based on a previous paper by the author (E. S. R., 11, p. 705).

Treacle, or golden sirup, E. W. T. Jones (*Analyst, 25 (1900), Apr., pp. 87–89*).—The method of analysis employed by the author is described.

Analysis of a sample of treacle and of so-called golden sirup, C. W. Matthews and A. H. Parker (*Analyst, 25 (1900), Apr., pp. 89–94*).—The methods employed and the results are discussed.

Accurate ash determination in molasses (*Deut. Zuckerind., 25 (1900), No. 2, p. 62*).

Detection of saccharin in articles of food, R. Truchon (*Ann. Chim. Analyt. et Appl., 5 (1900), pp. 48, 49; abs. in Chem. Centbl., 1900, I, p. 691; Jour. Chem. Soc. [London], 78 (1900), No. 451, II, p. 377*).

On the analysis of milk, L. Gallien (*Jour. Pharm. et Chim., 6. ser., 11 (1900), No. 2, pp. 61–64*).

A new process for the determination of fatty materials in dairy products, Lindet (*Bul. Soc. Chim. Paris, 3. ser., 23 (1900), No. 10, pp. 409–413, fig. 1*).

The so-called ferment-reaction of milk, R. W. Raudnitz (*Centbl. Physiol., 12 (1898), pp. 790–793; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 3 (1900), No. 5, p. 329*).

Determination of fat in butter by the Gerber acid butyrometric method, J. Werder (*Chem. Ztg., 23 (1899), No. 97, p. 1028*).

A means of recognizing margarin and cocoa butter in butter, Cotton (*Abs. in Jour. Pharm. et Chim., 6. ser., 9 (1899), No 10, pp. 505, 506*).

Studies on the color reactions of Becchi and Halphen for the identification of cotton-seed oil, P. N. Raikow and N. Tscherweniwanow (*Chem. Ztg., 23 (1899), No. 97, pp. 1025–1028*).

Concerning butter produced on sesame feeding and the official recognition of margarin, G. Baumert (*Ztschr. Naturw. [Jena], 71 (1899), No. 6, pp. 425–434*).—The German law requires the addition of sesame oil to margarin to aid in its detection. The article discusses the reliability of this reaction for margarin when sesame cake has been fed.

The effect of formic aldehyde on proteid bodies. The change of peptones and albumoses into primary proteids, C. Lepierre (*Jour. Pharm. et Chim., 6. ser., 9 (1899), pp. 449–451; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 12, p. 924*).

The solubility of proteoses and peptones in alcohol, J. Effront (*Bul. Soc. Chim. Paris, 3. ser., 21 (1899), pp. 676–680; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 3 (1900), No. 1, pp. 38, 39*).

The solvent power of pepsins, J. Effront (*Bul. Soc. Chim. Paris, 3. ser., 21 (1899), pp. 683–691; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 12, pp. 924, 925*).

Chemical changes in wheat and rye when moldy and sprouted, R. Scherpe (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), pp. 550–559*).

The adulteration of nutmegs, J. Vanderplanken (*British Food Jour., 2 (1900), No. 15, p. 65*).—Brief directions for detecting nutmegs made from an inferior quality of ground nutmeg and clay.

A general method for the determination of various simple substances contained in organic compounds, M. Berthelot (*Compt. Rend. Acad. Sci. Paris, 129 (1899), No. 24, pp. 1002–1005*).

Studies on the progressive development of the essence of bergamot, E. Charabot (*Compt. Rend. Acad. Sci. Paris, 129 (1899), No. 19, pp. 728–731*).

On the determination of pentosans, W. L. A. Warnier (*Bul. Soc. Chim. Paris, 3. ser., 21 (1899), No. 10, p. 527*).

Automatic apparatus for the estimation of pentosans, V. Staněck (*Böhm. Ztschr. Zuckerind., 24 (1899), pp. 227–230; abs. in Jour. Chem. Soc. [London], 78 (1900), No. 451, II, p. 373*).

An apparatus for washing and absorbing gas, A. GAUTIER (*Bul. Soc. Chim. Paris, 3. ser., 23 (1900), No. 5, pp. 141–144, fig. 1*).

A simple gas generator, C. E. WAIT (*Univ. Tennessee Record, 1899, No. 11, pp. 259, 260, fig. 1*).—A simple, cheap, and effective apparatus is briefly described and illustrated.

A rubber mortar-cap for pulverizing with exclusion of air, R. SCHOLL (*Chem. Ztg., 24 (1900), No. 3, p. 15, fig. 1*).—A flexible rubber sheet which fits securely over the top of the mortar, with a hole in the center for the pestle.—J. T. ANDERSON.

A universal pipe-stem triangle, L. MARTIUS (*Chem. Ztg., 24 (1900), No. 3, p. 15, fig. 1*).—Two of the sides of the triangle are fixed in the usual way, while the third arm is hinged at one point with the other end free, thus allowing the size of the triangle to be shifted at pleasure. A notched wire, running parallel to one of the sides of the triangle, holds the free end of the movable side securely in any desired position.—J. T. ANDERSON.

New triangles for crucibles and dishes, A. HEBEBRAND (*Chem. Ztg., 24 (1900), No. 5, p. 37, figs. 2*).—The crucible or dish is supported on three platinum pegs screwed into the side of an iron triangle vertically to these sides, and at angles of 45° to their plane.—J. T. ANDERSON.

BOTANY.

On biastrepsis in its relation to cultivation, H. DE VRIES (*Ann. Bot., 13 (1899), No. 51, pp. 395–420*).—The author designates under the term biastrepsis the twisting of the stem which sometimes occurs in plants, the normal shoots of which have opposite or whorled leaves. By this twisting the phyllotaxis becomes spiral instead of verticillate, and the successive leaves of the spiral are connected by their bases.

A large number of experiments with *Dipsacus sylvestris torsus* are reported, from which it is concluded that under proper cultivation the seeds of this plant will yield about one-third twisted stems. This proportion was first attained in the fourth generation, and since then the proportion has increased.

The phenomena of biastrepsis depend not only upon the hereditary properties of the seed, but also upon the external conditions under which the individual develops. The more favorable the conditions of life the richer is the progeny obtained from any given seed in individuals with twisted stems, and the more marked is the twisting in individuals. The importance of plenty of space, time of sowing, and character of soil are pointed out.

From these experiments the general statement is made that with a given hereditary tendency, any monstrosity becomes more marked the more favorable the conditions of life, and, therefore, the more vigorous the growth. This is true not only of *Dipsacus sylvestris*, but is established for most various plants and different monstrosities by observations made by the author during the past 10 years.

The influence of carbon dioxid on the form and structure of plants, E. C. TEODORESCO (*Rev. Gén. Bot., 11 (1899), No. 132, pp. 445–470, pl. 1, figs. 18*).—A report is given of a series of experiments in which a number of plants were grown with and without carbon

dioxid. An apparatus was devised by which air free from carbon dioxid could be supplied to one bell jar, and to another an atmosphere containing approximately 2 per cent of carbon dioxid. By means of an aspirator the atmosphere was constantly changed. The plants used were *Marchantia polymorpha*, *Lunularia vulgaris*, *Lupinus albus*, *Phaseolus multiflorus*, *Faba vulgaris*, *Pisum sativum*, *Asparagus officinalis*, *Cucurbita pepo*, *Borrago officinalis*, and *Datura stramonium*.

The morphology of thallus, stem, and leaves is fully described. In the case of the hepatics, the thallus was less developed, less branched, and no asexual reproductive organs were produced when grown in an atmosphere free from carbon dioxid. The assimilative tissues, usually present in the large air cavities, were wholly absent in the case of Marchantia and greatly reduced in Lunularia. The air spaces were likewise either wholly or nearly obliterated.

Where plants were cultivated from seed, the stems for a time grew best in an atmosphere which did not contain carbon dioxid, the presence of that gas retarding the consumption of the reserve material. However, after the plant had used up its reserves and chlorophyll assimilation begun, the best growth was obtained in an atmosphere containing carbon dioxid. Those plants which were not cultivated from seed, but were already in an advanced stage of growth, did not show the preliminary phase just described, but continued their growth best in the atmosphere charged with carbon dioxid. The leaves of the plants were smaller when grown without carbon dioxid. In the case of the Datura leaves, those already formed, when placed in an atmosphere lacking in carbon dioxid, became yellow and fell off. In nearly every case the leaves were thicker and the palisade parenchyma longer and larger, the air spaces more developed, with all plants which grew in the atmosphere charged with carbon dioxid. The internodes in general section were larger, the number of fibro-vascular bundles greater, and the individual bundles developed to a greater extent.

The influence of different kinds of light on the form and structure of plants, E. TEODORESCO (*Ann. Sci. Nat. Bot., 8. ser., 10 (1899), Nos. 3–4, pp. 141–256; 5–6, pp. 257–264, pls. 4, figs. 20*).—In order to study the effect of rays of different refrangibility on the form and structure of plants, the author made use of the spectrum and colored screens, the colors used being red, blue, and green, and comparisons were made with plants grown in light and darkness. The effect of these different lights, as shown by the morphology and anatomy of leaf, stem, and root, were studied, the experiments being described in detail. The following plants were used: Horse beans, white lupines, buckwheat, castor beans, peony, evening primrose, *Rubus fruticosus*, live-forever, peanut, vetch, white beans, pepper grass, chick-pea, gourd, sunflower, hemp, horse-chestnut, potato, ash tree, maple, oak, and syringa.

The principal results are summarized as follows:

The greatest expanse of leaf blade was in those plants under blue light, the least under the green light, with the red intermediate. Those under the blue light approached most nearly to the total illumination and the green to darkness. The effect on the petioles varied but in two ways. In one series the green rays produced the longest petioles, with the shortest under the blue, and intermediate under red illumination. In the other the order was reversed. With those plants having a rosette of root leaves the longest leaves grew under the green screen and the shortest under the blue, with red intermediate. At the same time the longest leaves were not always the largest. All the different colored lights were less favorable to the development of the tissues of the leaves than the white light.

The amount and development of the palisade tissue, parenchyma, and air spaces were least under green light, greater under red, and most highly developed under blue light. The chloroleucites, so far as number, size, and disposition were concerned, were similar in development to the assimilative tissues. Under the green light they were small, fewer, of indefinite shape, and distributed without any order in the cell and did not contain as much chlorophyll as either under the red or blue. The number of stomata per unit of leaf surface was greatest under the green light, less under the red, and least under the blue. The development of wood, liber, and cambium of the veins, as well as the lignification of the cell walls of the leaves, was the same as in the stems and roots.

The studies of roots showed that for plants whose roots are retarded by white light, blue light retarded them still more, while under green light they attained greater length, although the maximum development was in darkness. When roots developed better in light than in darkness they showed increased growth under blue screens and made little increase under green. When growing equally as well in light and darkness the different colored lights made no appreciable difference. The maximum diameter of the central cylinder and thickness of cortex of roots was shown in the plants grown under red and blue light, with green as the minimum. Under the green light the primary wood presented few vessels and the differentiation of secondary tissues was less advanced. The same was true for the lignification of cell walls and supporting tissues. Under the green light the structure of roots approached those grown in darkness, while those under blue light were more nearly like those grown under white light.

The investigations showed that the green light gave the greatest growth of stem, followed by red and blue when the experiment was not continued beyond the consumption of the reserve materials of the plant. When conducted longer the plants under green light perished.

The development of the primary and secondary conductive tissue and lignification of cell walls was the same as for the roots. The central cylinder of the stem increased most rapidly under blue light and least under green, with red as intermediate. The periderm of the stem was least developed under green light, most under blue, and red intermediate.

The influence of changes of temperature on the respiration of plants, W. PALLADIN (*Rev. Gén. Bot., 11 (1899), No. 127, pp. 241–257*).—The extremities of etiolated seedlings of *Vicia faba* with a few leaves were cut off and placed in vessels containing a 10 per cent solution of saccharose. One lot was kept in the laboratory at an average temperature ranging from 17 to 20° C. A second lot was placed in a vestibule where a lower temperature, 7 to 12° C., was experienced, and the third lot was placed in a thermostat in which a temperature of from 36 to 37.5° C. was maintained. After from 3 to 7 days in these temperatures equal lots were brought together and kept at a medium temperature of from 18 to 22°, and the amount of carbon dioxid liberated per gram of plants was ascertained.

It was found that the plants which had been kept in the medium temperature gave off 55.8 mg. per gram; those removed from the low temperature to the medium gave off 78.1 mg.; and those from the highest to the medium temperature, 85.4 mg. per gram of plant weight. The change from a lower to a higher or a higher to a lower temperature resulted in an increased respiration. The cause for this phenomenon was not ascertained.

On the influence of anæsthetics on the respiration of plants, N. MORKOWINE (*Rev. Gén. Bot., 11 (1899), Nos. 128, pp. 289–303; 129, pp. 341–352*).—The author experimented with the etiolated leaves and leaf buds of *Vicia faba* and *Lupinus luteus* and the green leaves of *Ficus elastica* and *Phylodendron* sp.; also upon the embryos of sprouted wheat. As anæsthetics, alcohol, ether, hydrochlorate of morphine, and hydrochlorate of solanin were used. The plants were placed in a Pettenkofer apparatus and the respiration determined. The experiments are described in detail.

Contrary to the conclusions of Bonnier and Mangin,[1] the author found that if the exposure to anæsthetics be prolonged for quite a number of hours, or even for several days, the intensity of respiration was considerably increased. Under the influence of alcohol, the intensity of the respiration of etiolated plants was increased 1½ times. With ether, the respiration of etiolated leaves of *Vicia faba* was more than doubled. It was found that the hydrochlorate of morphine, 1:2,000, did not in any way affect the respiration of plants. When, however, the quantity or morphine was 1:500, the respiration of the plants was increased 1½ times.

[1] Ann. Sci. Nat. Bot., 7. ser., 1886, p. 5.

In general, the author states, his experiments show that anæsthetics increase the respiration not only in etiolated but in green plants. Incidentally, the effect of anæsthetics on chlorophyll was investigated, and it was found that a 5 per cent solution of alcohol checked the chlorophyll production and growth of the wheat germ. The diminution in the respiration in the case of the plantlets was in proportion to their growth.

Experiments on floral colors, P. Q. Keegan (*Nature, 61 (1899), No. 1570, pp. 105, 106*).—The author conducted a series of experiments to determine the true color of anthocyan—that is, the blue and red pigment of flowers. The opinions of Berzelius and Wiesner are stated, in which diametrically opposite conclusions are given.

The author observed the effect produced by immersion of fresh petals of a number of flowers into ether saturated with ammonia. The petals of the peony, pink, campion, deep-red rose, sweet pea, vetch, mallow, balsam, geranium, fuchsia, scarlet rhododendron, crimson flax, and blue centaurea became blue; of the red daisy, periwinkle, and lady's smock, bluish green; while the petals of anemone, larkspur, violet, willow herb, scarlet Tropæolum, red rhododendron, flowering currant, scabious, wild thyme, potato, and forget-me-not became green.

Later the coloring matter was withdrawn from the petals by macerating them for 2 days in methyl alcohol, after which the solution was drawn off, evaporated to dryness, the residue dissolved in warm water, and after filtering was tested with hydrochloric acid, ammonia, lead acetate, and magnesium acetate, the color reaction in each case being given.

The author's conclusion is that there are different stages in the development of floral pigments. In the lower stages the natural color is red, whatever the chromogen may be. In the higher stages the natural color of the anthocyan is blue, or is capable of forming blue compounds with alkalis and certain metallic salts.

On the presence of vanadium, molybdenum, and chromium in plants, E. Demarçay (*Compt. Rend. Acad. Sci. Paris, 130 (1900), No. 2, pp. 91, 92; abs. in Rev. Sci. [Paris], 4. ser., 13 (1900), No. 3, p. 88*).

On the presence of dextrose and levulose in the leaves of beets, L. Lindet (*Ann. Agron., 26 (1900), No. 2, pp. 103–113*).

On the composition of the leaves of the plane tree from the standpoint of nutritive material and on the migration of this material during growth and after the death of the leaves, G. M. Tucker and B. Tollens (*Ber. Deut. Chem. Gesell., 32 (1899), pp. 25–75; abs. in Bul. Soc. Chim. Paris, 3. ser., 24 (1900), No. 10, p. 480*).

On the modifications which oil of lavender undergoes during the growth of the plant, E. Charabot (*Bul. Soc. Chim. Paris, 3. ser., 23 (1900), No. 5, pp. 183–189*).

Behavior of leguminous tubercles in water culture, F. Nobbe and L. Hiltner (*Landw. Vers. Stat., 52 (1899), Nos. 5–6, pp. 455–465*).—In experiments with seedlings of *Robinia pseudacacia* grown in water cultures, the root tubercles functioned

normally in air, but under water almost none at all. The authors believe that the results obtained in these experiments demonstrate that nitrogen assimilation takes place within the root tubercles and not in the leaves.

Further observations on Nitragin and on the nature and functions of the nodules of leguminous plants, M. DAWSON (*Proc. Roy. Soc. [London], 66 (1900), No. 425, pp. 63–65*).

A new departure in cytology (*Nature, 61 (1900), No. 1582, pp. 385–387*).—A review of a recent work by A. Fischer, of Leipsic.

FERMENTATION—BACTERIOLOGY.

Variability in the power of liquefying gelatin possessed by bacteria, H. W. CONN (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 20, pp. 665–669*).—On examining specimens of milk from a neighboring dairy, the author discovered 2 rather constant organisms in his cultures. The first was a Micrococcus and seemed to be almost universally found in all the specimens of milk. Its morphology is described at some length. With it, and almost equally abundant, was found a bacterium which differed from the first in having no power of liquefying gelatin. As experiments with the organisms were continued, it was found that intermediate grades existed between the two, and after continuing the experiments for several months, the author arrived at the conclusion that he had one organism which showed a wide variability. Subsequent study of the culture proved that with the exception of the power of liquefying gelatin the organisms were absolutely identical.

Permanent forms of nitric and nitrous organisms, A. BEDDIES (*Chem. Ztg., 23 (1899), No. 63, pp. 645–647; abs. in Jour. Chem. Soc. [London], 78 (1900), No. 446, II, p. 34*).—From manure, sewage, etc., the author prepared nutritive solutions containing about 2 gm. each of organic and inorganic matter per liter. These were mixed with 1 to 2 per cent of meat juice and the nitrogen content was raised to about 3 per cent by the addition of ammonium sulphate. The alkalinity was raised or lowered as desired by the addition of sodium carbonate or phosphoric acid, and, after sterilizing, the solutions were inoculated with 0.1 to 0.2 gm. of soil containing the nitrifying organisms. The cultures were kept in diffused light at 20 to 25° until nitrification was complete (2 to 3 months). Material from these cultures was used for inoculating sterilized solutions containing 1 per cent of a cold water extract of a soil rich in humus and 0.25 per cent of water glass.

By this means nitrifying organisms were obtained which were less sensitive than those obtained by Winogradsky in inorganic media. Four stable forms of nitric and 3 of nitrous bacteria were isolated. One of the nitric forms was capable of resisting the action of steam at 100° for 2 minutes, and one of the nitrous bacteria lived for 1 minute in steam at the same temperature. The other two nitrous bacteria could not withstand steam, but survived for several minutes in a dry

heat of 80 to 100° C. Nitric and nitrous bacteria grew in the same medium without interference, and inoculating material was prepared by drying previously sterilized calcareous soil to which both forms of nitrifying organisms had been added.

Pot experiments are reported in which grasses and cereals grown on sterilized sand, to which sterilized humus, ammonium sulphate, and minerals were added, were much benefited by inoculation with the nitrifying organisms.

The results obtained indicate that denitrification is hindered and loss of free nitrogen prevented by the presence of an abundance of nitrifying organisms. When, however, denitrifying organisms predominate, the action of the nitrifying bacteria is interfered with, especially if the supply of oxygen is limited.

On the nitrification of organic nitrogen, V. OMELIANSKI (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 13, pp. 473–490*).—An account is given of various culture experiments, the results of which led to the conclusion that pure cultures of nitrifying bacteria are incapable of nitrifying organic nitrogen. Nitrogen in this form must first be converted into ammonia by the action of other nitro-organisms before the nitrifying organisms can utilize it. It is claimed that the opposite conclusions reached by Frankland, Warington, and Stutzer and his associates were based upon inaccurate observations.

Denitrification and fermentation, K. WOLFF (*Hyg. Rundschau, 9 (1899), pp. 1169–1172; abs. in Chem. Centbl., 1900, I, pp. 52, 53; Jour. Chem. Soc. [London], 78 (1900), No. 450, II, p. 298*).—In experiments with typhus-like bacilli, including *B. coli commune* and others, and 2 hay bacilli, one apparently *B. fitzianus* from ginger root and the other from meal, it was found that while all the organisms reduced nitrates to nitrites in 1 per cent dextrose broth containing 0.05 to 0.23 per cent of potassium nitrate, the hay bacilli were much more active in this respect than the others, although only one of the bacilli can be compared with the real denitrifying organisms. The activity of the organisms was not affected by the strength of the sugar solution, but was decidedly influenced by the amount of nitrate present, an excess of the latter checking fermentation without otherwise disturbing the functions of the organisms. Complete disappearance of nitric nitrogen took place simultaneously with fermentation. The author concludes that denitrification is not due to the direct action of the organisms, but that the products of fermentation reduce nitrates to nitrites and eventually convert them into carbonates.

Recent investigations on the development of aromatic principles by alcoholic fermentation in the presence of certain leaves, G. JACQUEMIN (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 6, pp. 369–371*).—In a previous number of this publication[1] the author

[1] Compt. Rend. Acad. Sci. Paris, 125 (1897), No. 2, p. 114.

has given an account of his investigations in which he claims the development of aromatic principles through the alcoholic fermentation of wine in the presence of the leaves of the apple, pear, or grape, producing the characteristic odor and flavor of the individual fruit. This, he says, is brought about by the splitting up of certain glucosids contained in the leaves through the action of a diastase secreted by the yeast used in the fermentation. Subsequent investigations have shown that the leaves of different varieties of grapes placed in the must give to the wine different flavors and bouquets. If instead of the leaves an extract containing the glucosids of the leaves be used in connection with the pure yeast, the same result is secured.

The author states that during the past season numerous experiments were carried on in different parts of France with both white and red wines which confirm his statement. One experiment is quoted in which the must of an ordinary red wine was pasteurized and divided into equal portions, one of which received an extract of the leaves from a St. Emillion grapevine which had been prepared by mixing them with a pure yeast 2 days before adding to the must; the second was given a pure yeast, while a third lot was allowed to ferment in the ordinary manner. The products of the fermentation were submitted to various experts. That resulting from the fermentation in the presence of the extract of the leaves was pronounced far superior to the others.

In conclusion the author claims that his experiments show that by the use of grape leaves from varieties of superior excellence, or of extracts containing the glucosids from these leaves, even in a quantity as small as 1:1000, the quality of the wine may be greatly improved.

Investigations concerning bacteria in the fermentation of tobacco, J. H. VERNHOUT (*Meded. S'Lands Plantentuin, 34 (1899), pp. 49, pls. 2*).—The author has investigated the fermentation of tobacco and concludes that (1) the fermentation of tobacco is due in whole or in part to the chemical action of bacteria, and (2) a thermophile bacterium plays an important rôle in the process of fermentation. In support of these conclusions he gives a detailed account of his work. Germs that could flourish at 50° C. were first isolated from tobacco leaves in which the process of fermentation had been completed. Two germs which he studied under the designations A and B were thus isolated. Inoculation experiments were made by cutting into small pieces or by folding tobacco leaves in which fermentation had just commenced. The pieces or folded leaves were placed in petri dishes and sterilized at 120° C. for 45 minutes to 1 hour, after which one dish was inoculated with a pure culture of germ A. Seven experiments are recorded, of which 1 gave positive results, 4 doubtful, and 2 negative. In the last-mentioned experiments fermentation took place equally well in the check and in the inoculated dish. Two

experiments were also made in which some dishes were sterilized while the check was left unsterilized. In both cases fermentation took place in the check but not in the sterilized dish.

One chapter is devoted to a description of germ A on different culture media. This germ is related to *Bacillus subtilis* and the author proposes for it the name *Bacillus tabaci-fermentationis*. Germ B is also described and said to belong to the genus Bacterium. The name *Bacterium tabaci-fermentationis* is proposed.—H. M. PIETERS.

On the chemical nature of enzyms, O. LOEW (*Science, n. s., 10 (1899), No. 261, pp. 955–961*). —The author states that enzyms may be physiologically classified into 3 groups, those which are intimately connected with nutrition, such as diastase, pepsin, trypsin, lipase; those causing oxidation, as the oxidases; and those producing coagulations, such as rennet, thrombase, and pectase.

In considering the chemical nature of enzyms, 3 important questions have received attention: (1) Are the enzyms proteins or not? (2) how is the fact to be explained that a very small amount of the enzyms can transform a relatively large amount of another compound? and (3) what is the cause of their specific action, that is, why can enzyms attack only a specific compound and not others closely related? The different investigations bearing upon these subjects are reviewed at some length. The author believes that the tendency on the part of some authors to infer from the nature of one enzym the nature of all others is not justified. He believes there may exist enzyms in every group of proteins, and that there may be some that are not proteins but which are derived therefrom.

The action of small quantities of enzyms on large quantities of other substances is explained by the close connection existing between lability and activity, and further by the principle of intensity of energy by which their chemical energy may be transferred to other compounds. In explaining the specific action of enzyms, the principle of configuration of molecules comes in, and the closer the contact the more perfect transmission of energy is possible.

Report of the bacteriologist, H. H. LAMSON (*New Hampshire Sta. Bul. 68, pp. 158–164, fig. 1*).—A statement is made of the lines of work followed in the department of bacteriology during the year and a popular account is given of bacteria, their morphology, physiology, and relations to agriculture.

Bacteria and their place in systems of fungi, W. WINKLER (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), Nos. 16–17, pp. 569–579; 18–19, pp. 617–630, pls. 2*).

The classification of bacteria, W. MIGULA (*System der Bakterien. Jena: G. Fischer, 1900, vol. 2, pp. 1068, pls. 18, figs. 35*).—A systematic classification of bacteria.

Bacteria as related to economy of nature, industrial processes, and public health, G. NEWMAN (*New York: G. P. Putnam's Sons; London: John Murray, 1899, pp. 348; rev. in Science, n. ser., 11 (1900), No. 263, p. 70*).

Micro-organisms useful in agriculture, F. CAVARA (*Bul. Soc. Bot. Ital., 1899, No. 7–8, pp. 241–243*).

Bacteria in milk products and other food materials, BLOCH (*Berlin. Klin. Wchnschr., 37 (1900), No. 4, pp. 85, 86*).—The author found numbers of bacterial colonies in cultures from plasmon, but an equally large number from nutrose and other milk products.

Contribution to the morphology of the organism described as Bacterium radicicola, A. STUTZER (*Mitt. Landw. Inst. Breslau, 1900, No. 3, pp. 57–71*).

The influence of sunlight on bacteria, L. KEDZIOR (*Arch. Hyg., 36 (1899), No. 4, pp. 323–334*).

Gypsum plates for the cultivation of nitrification bacteria, V. OMELIANSKI (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 18–19, pp. 652–655*).

On the multiplication of yeasts without fermentation in presence of a limited quantity of air, A. ROSENTIEHL (*Compt. Rend. Acad. Sci. Paris, 130 (1900), No. 4, pp. 195–198*).

The length of generations in certain yeasts, D. P. HOYER (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 21, pp. 703–705*).—A large number of species of yeast were studied and under the conditions of experiments the time elapsing between one generation and another determined. It ranged from 3.5 hours to about 10 hours, depending upon the temperature.

On the duration of the vitality of dried yeast, H. WILL (*Ztschr. Gesam. Brauw., 1899, No. 4, p. 43; abs. in Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 14, p. 527*).—Yeast is said to have grown readily after having been kept in a dried state for 12 years and 2 months.

Soluble ferments produced during germination of seeds having a corneous endosperm, E. BOURQUELOT and H. HÉRISSEY (*Compt. Rend. Acad. Sci. Paris, 130 (1900), No. 1, pp. 42–44*).

The oxy-ferments of milk and saliva, R. DUPOUY (*Jour. Pharm. et Chim., 6. ser., 8 (1898), pp. 551–553*).

On the secretion of diastases, DIENERT (*Compt. Rend. Acad. Sci. Paris, 129 (1899), No. 1, pp. 63, 64*).

On the so-called indigo fermentation and new indigo plants, H. MOLISCH (*Sitzber. Math. Naturw. Cl. K. Akad. Wiss. [Vienna], 107 (1898), No. 7, pp. 747–776, pl. 1*).

The action of formaldehyde on enzyms and certain proteids, C. L. BLISS and F. G. NOVY (*Jour. Expt. Med., 4 (1899), No. 1, pp. 47–80*).

METEOROLOGY.

Monthly Weather Review (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 28 (1900), Nos. 1, pp. 1–48, charts 10; 2, pp. 51–93, pl. 1, figs. 5, charts 11; 3, pp. 95–139, charts 10*).—In addition to the usual reports on forecasts, warnings, weather and crop conditions, meteorological tables and charts, these numbers contain the following articles and notes:

No. 1, a special contribution on Some of the results of the international cloud work for the United States, by F. H. Bigelow; and notes by the editor on wireless telegraphy, lightning rods, a kite and balloon station near Berlin, Germany, South African meteorology, frost work in South Africa, Prof. Henry Allen Hazen, winterkilling of fruit trees, farmers' bulletins, the soil and the crops, errors in school books, fruit protection in Florida, historical events in meteorology, irrigation in winter, the Weather Bureau and commerce on the Great Lakes, the high stations of Wyoming, winter thunderstorms in Mississippi, snowfall in the Rocky Mountains, the relation of temperature to color, Meteorological Congress at Paris, September 10–16, 1900,

meteorology at the Paris Exposition, lectures in the schools, long dry spells, lectures at farmers' institutes, climatology of San Diego, Cal., wind-roses for Oklahoma, Charles G. Boerner, artificial rain, and the weather maker.

No. 2, special contributions on Anemometer tests (illus.), by C. F. Marvin; Kite observations at Bayonne, N. J., by the Bayonne Kite Club; and notes by the editor on climatology of St. Kitts, lectures at farmers' institutes, a change at Kew observatory, the London meteorological office, maximum pressure of wind, and George James Symons.

No. 3, special contributions on Comparative thermometer readings at New York, by A. J. Henry; Loss of life in 1899 by lightning, by A. J. Henry; Hurricanes of 1895 and 1896 in the Philippine Archipelago, by F. O. Stetson; Notes on climate in the Philippines, by I. N. Brewer; A partial explanation of some of the principal ocean tides (illus.), by R. A. Harris; and notes by the editor on the measurement of radiant heat, the use of the divining rod in the search for water, tides in the ocean and the atmosphere, solar spots and terrestrial phenomena, the storms of March, 1888 and 1900, frost protection by hot water, the total eclipse of the sun May 28, 1900, stations of the Mexican Telegraph Company, influence of the wind and of rythmic gusts on the level of Lake Erie, long balloon voyages, wireless telegraphy, storms of sleet, the cold waves of January and February, 1864, a Black River thaw, sudden disappearance of ice in the lakes, benefits and injuries due to storms, waterspout, objectionable meteorological terms, danger lines on gages and contour lines on city maps, the legal value of Weather Bureau records, and sudden temperature changes in Montana.

Maryland Weather Service (*Maryland Weather Service, 1 (1899), pp. 566, pls. 54, figs. 61*).—This is the first of a proposed series of reports dealing with the climatic features of Maryland, including the physiography, meteorology, hydrography, medical climatology, agricultural soils, foresty, crop conditions, and flora and fauna of the State. The present volume is confined to a discussion of physiography and meteorology, and includes the following articles: Introduction, by W. B. Clark, explaining the establishment of the State weather service and the lines of investigations pursued; A general report on the physiography of Maryland, and The aims and methods of meteorological work, by C. Abbe; A sketch of the progress of meteorology in Maryland and Delaware, by O. L. Fassig; and An outline of the present knowledge of the meteorology and climatology of Maryland, by F. J. Walz.

A summary of the main results of meteorological observations in Maryland is as follows:

Normal annual temperature 53 to 54° F.; normal annual maximum 63°; normal annual minimum 45°; highest normal monthly temperature 75.5° in August; lowest normal monthly 31° in January; absolute maximum temperature for the State since 1891, 109° at Boettcherville in July, 1898; minimum for the State since 1891, −26 at Sunnyside in February, 1899; average date of last killing frost in spring April 5 to 15; first killing frost in fall October 5 to 15; advent of spring (average temperature 43.8°) March 7 in southern Maryland, April 1 in northern Maryland, and April 15 in northwestern Maryland; average barometric pressure for 28 years at Baltimore 30.7 in., highest 30.98 in., lowest 29 in.; normal annual precipitation (rain, melted snow, etc.) 43 in. (of this 23 to 24 in. falls in the spring and summer and 19 to 20 in. in fall and winter); rainy days 168; cloudiness 50 to 60 per cent; average humidity 68 per cent; direction of the wind northwest in winter, south and southwest in summer.

Meteorology, C. H. PETTEE (*New Hampshire Sta. Bul. 68, pp. 164, 165, 168–192*).—This gives brief notes on additions to equipment of the meteorological department and on the weather of the year, and a monthly and annual summary for the period from July, 1898, to June, 1899, inclusive, of observations at Durham, N. H., on temperature, precipitation, cloudiness, and prevailing winds. The mean temperature for the year was 45.9°, for 4 years ending June 30, 1899, 45.8°; total precipitation for the year 43.6 in., average for 4 years 45.5; snowfall 82 in., average for 4 years 67; number of days on which there was precipitation of 0.01 of an inch during 1898 to 1899, 107, average for 4 years 105; prevailing direction of the wind, northwest; clear days 114, partly cloudy days 161, cloudy days 80.

"The last 3 months of the year [1898–99] were abnormally dry, with a total precipitation of only 3.6 in. Indeed this lack of rain was the chief feature of the weather for the year, and had a marked effect upon farm crops, especially grass, the amount of hay harvested in this vicinity being about one-half of that of the previous year. Hoed crops on heavy soil did not suffer seriously."

Meteorological summary for Ohio, 1898, C. A. PATTON (*Ohio Sta. Bul. 109, pp. 373–386*).—Notes on the weather and tabulated daily and monthly summaries of observations at the station on temperature, precipitation, cloudiness, direction of the wind, etc., are given, and for comparison similar data for previous years and for other parts of the State. The following is a summary of results:

Summary of meteorological observations in Ohio.

	For the experiment station.				For the State.			
	1898.		Average for 11 years.		1898.		Average for 16 years.	
Temperature (°F.):								
Mean		50.4		49.0		52.0		50.7
Highest	(July 3)	96	(Aug. 8, 1891)	99	(July 1)	105	(July 4, 1897)	113
Lowest	(Feb. 2)	−9	(Jan. 20, 1892)	−20	(Feb. 3)	−20	(Jan. 25, 1884)	−34
Range		105		119		125		117.1
Mean daily range		20.3		20.3		....		....
Greatest daily range.	(Nov. 14)	50	(Oct. 6, 1895)	55		....		....
Least daily range	(Jan. 21, Mar. 2, Dec. 18.)	5	(Feb. 6, 1897)	0		....		....
Clear days		133		120		130		118
Fair days		104		122		110		122.5
Cloudy days		128		118		125		124.7
Days rain fell		134		126		121		123.6
Rainfall (in.):								
Greatest monthly	(July)	6.79	(July, 1896)	8.05		....		....
Least monthly	(Sept.)	2.15	(Sept., 1897)	.29		....		....
Mean yearly		47.85		39.75		43.78		37.85
Prevailing direction of wind.		N–SW.		SW.		SW.		SW.

Relations between the annual variations of temperature and the successive phases of vegetation, A. DESMOULINS (*Ann. École Nat. Agr. Montpellier, 11 (1899–1900), pp. 9–51*).—This is a very full discussion of this subject, based upon observations by the author and others at Montpellier, and by other investigators in different parts of

France, and includes (1) the duration of the stages of growth of different plants and their relation to temperature, and (2) the sums of temperature necessary for the maturing of different plants. The different stages of plant growth from seeding to harvest are treated in detail. The main results of observations at Montpellier are summarized in the following table:

Stages of growth and sums of temperature required for the maturing of different plants.

	Date of planting.	Time required for—				Sums of temperature required for growth and maturity.[a]
		Germination.	Heading.	Blooming.	Maturity.	
		Days.	*Days.*	*Days.*	*Days.*	*Deg. C.*
Wheat (Noé)	End of October or beginning of November.	13	195	199	237	2398
Spring wheat	March 15	16	91	96	124	1760
Rye	End of October or beginning of November.	14	174	188	230	2240
Barley	do	14	185	190	223	2100
Winter oats	do	14	201	205	231	2220
Corn (from the Landes)	April 10	15	....	80	150	2730
Corn (Caragua)	do	14	....	110	167	....
Corn (Cinquantin)	do	13	....	86	136	....
Sorghum (saccharine)	April 1	18	....	120	165	2894
Buckwheat	do	7	....	29	136	....
Flax	March 3	15	....	63	105	1555
Beans (haricot)	April 15	15	....	49	89	1611
Beets	March 15	22	....	11	205	3470
Jerusalem artichokes	Beginning of March	37	....	191	221	3665
Potatoes	do	37	....	92	135	2287

[a] Calculated according to the Hervé-Mangon method from the sums of the daily temperatures (average of the maxima and minima) received by the plant from the time of planting to the time of harvest, discarding all average temperatures below those required for the growth of plants, *i. e.*, 6° C. for wheat, 9° for corn, etc.

Meteorological observations at Michigan Agricultural Experiment Station for the year 1898, R. C. KEDZIE (*Michigan Sta. Rpt. 1899, pp. 79–103*).—Tabulated daily and monthly summaries of observations during 1898 on temperature, pressure, precipitation, humidity, cloudiness, wind movement, etc.

The summary for the year is as follows: Mean temperature, 48.17° F.; humidity, 89.6 per cent; atmospheric pressure (reduced to 32° F.), 29.12 in.; cloudiness, 48 per cent; amount of rain or melted snow, 31.72 in.; snowfall, 44.25 in.; number of thunderstorms, 10.

Meteorological observations, W. B. ALWOOD (*Virginia Sta. Rpt. 1899, p. 10*).—A tabulated monthly summary is given of observations at Blacksburg, Va., during the year ended June 30, 1899, on temperature, precipitation, snowfall, and cloudiness, and for 7 years (1893–1899) on temperature and rainfall. The mean temperature of the year ended June 30, 1899, was 50.8° F., the rainfall 50.9 in.; average temperature for 7 years was 51.7°, and rainfall 37.78 in.

Meteorological summary for the year 1899, H. DUFOUR and D. VALET (*Chron. Agr. Canton Vaud, 13 (1900), No. 7, pp. 149–152*).—This is a summary of observations on temperature, precipitation, sunshine, and temperature of the soil at the Agricultural Institute at Lausanne.

A comparative study of variations in temperature and of rainfall at Aigoual and Montpellier, F. HOUDAILLE (*Ann. École Nat. Agr. Montpellier, 11 (1899–1900), pp. 52–97, figs. 7, charts 12*).—Comparative observations during 3 years (1896–1898) at these two points, one in the Pyrenees, the other in the plain, 65 kilometers apart and differing in altitude by 1,525 meters, are reported and discussed.

Numerous correlations between both temperature variations and rainfall at the two places are shown. The utilization of observations at the more elevated point in local forecasts is explained.

The dirurnal range of rain at the seven observatories in connection with the meteorological office, Great Britain, 1871–1890, R. H. SCOTT (*London: Darling & Son, Ltd., 1900, pp. 48*).

A severe sleet storm, H. VON SCHRENK (*Trans. Acad. Sci. St. Louis, 10 (1900), No. 5, pp. 143–150, pls. 2*).—An account is given of a sleet storm of unusual severity which occurred February 27, 1900, over a large tract of country, including parts of Missouri, Illinois, Indiana, and Ohio.

Prevention of hailstorms by the use of cannon, J. M. PERNTER (*Nat. Geogr. Mag., 11 (1900), No. 6, pp. 239–241*).

The average and maximum velocity of the wind at Montpellier, F. HOUDAILLE (*Ann. École Nat. Agr. Montpellier, 11 (1899–1900), pp. 98–110, figs. 3, charts 12*).—The methods and apparatus used are described and the results obtained during 1898 reported.

Frost and hot water protection (*California Fruit Grower, 25 (1900), No. 613, p. 1*).—This is an account of an experiment at Riverside, Cal., in which water was heated to 85° in a tubular boiler and allowed to flow through the irrigating ditches between the rows of trees. A short distance from the ditches the temperature was 36° while the normal was 32° or freezing temperature.

Artificial clouds as a means of protection against frost, F. SISGNE (*Prog. Agr. et Vit., 17 (1900), No. 12, pp. 322–325*).—A popular article.

The applications of meteorology to agriculture, J. VANDERVAEREN (*Rev. Gén. Agron. Louvain, 9 (1900), Nos. 2, pp. 60–70; 3, pp. 102, 103, pl. 1; 4, pp. 156–162*).—A general article.

The telegraphic weather service for German agriculture (*Mitt. Deut. Landw. Gesell., 15 (1900), No. 16, pp. 104–106*).

The periods of plant growth and the effects of climatic conditions on plants, A. DESMOULINS (*Ann. École Nat. Agr. Montpellier, 11 (1899–1900), pp. 5–8*).—A continuation of observations of previous years (E. S. R., 9, p. 1035).

WATER—SOILS.

The fruit soils of Virginia, W. B. ALWOOD (*Virginia Sta. Bul. 98, pp. 29–41, map 1*).—This is a compilation of available information on this subject, including the author's observations, and deals mainly with the economic phases of the question. In discussing the subject the State is divided into 6 natural divisions, viz: Tidewater, middle Virginia, Piedmont, the Blue Ridge section, the valley, and Appalachia. A map showing the extent of these different divisions, and the location of areas known to be adapted to pippin orchards, accompanies the article. "It is hoped that this publication will mark the beginning in the near future of a more critical study of certain phases of this all-important subject to fruit growers."

Analyses of soils, C. F. JURITZ (*Agr. Jour. Cape Good Hope, 16 (1900), No. 5, pp. 271–288*).—In continuation of the soil survey of Cape of Good Hope, previously referred to (E. S. R., 11, p. 823), the author collected and analyzed 60 samples of soil at different points in the George, Knysna, Uniondale, and Oudtshoorn Divisions of the

Province. Descriptions and analyses of these samples, with a discussion of their comparative agricultural value, are given. The average composition of the soils examined is as follows:

Average composition of western Cape of Good Hope soils.

Division.	Number of analyses.	Fine earth (passing ½ mm. sieve).	In fine earth. Lime.	Potash.	Phosphoric acid.	Nitrogen. *a*
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
George	16	81.0	0.040	0.055	0.047	0.157
Knysna	13	87.6	.100	.035	.041	.213
Uniondale	12	69.2	.057	.099	.064	.135
Oudtshoorn	19	79.0	.678	.145	.091	.131

a In soil passing 1 mm. sieve.

"The soils of the George district are, generally speaking, poor in lime and phosphates, and on the whole contain a fair amount of potash, while they are rich in nitrogen. The Knysna soils contain an even larger percentage of nitrogenous material, but are poor in potash and phosphoric oxid, lime being little better. Coming to Uniondale, there is also a general lack of lime, but potash and phosphates are present in fair quantity, together with a good percentage of nitrogen. The Oudtshoorn division shows a good quantity of lime and nitrogenous matter in the soil, and is also fairly satisfactory as regards potash and phosphoric oxid."

The behavior of water-soluble phosphoric acid in the soil, M. Ullmann (*Abs. in Chem. Ztg., 24 (1900), No. 20, Repert., p. 65; Chem. Centbl., 1900, I, No. 15, p. 830*).—In experiments on this subject it was found that the phosphoric acid of superphosphate applied as a top-dressing circulated in the soil, but remained soluble in water for months after application. The rapidity of reversion of course depends upon the amount of lime, magnesia, iron oxid, alumina, etc., present, but according to the author the rate of reversion in artificial soil mixtures may be misleading as to this action in natural soils.

Cultivation and weeding, P. P. Dehérain (*Ann. Agron., 26 (1900), No. 5, pp. 257–261*).—Pot and field experiments made by the author showed no benefits resulting from the cultivation of bare soil as regards moisture preservation by the formation of a top soil mulch. Irrigated soils in vetch contained considerably larger percentages of soil moisture than unirrigated soils in vetch, but both soils showed from 25 to 50 per cent less moisture than soils on which no plants whatever were growing. Weeds allowed to grow in crops have an effect similar to the vetch in evaporating soil moisture. The author believes the results of his experiments show that "cultivation" and "weeding" are words of equal value, both being beneficial in preserving soil moisture in so far as they destroy weeds.

A new method for the mechanical analysis of soils, G. Scarlata (*Staz. Sper. Agr. Ital., 32 (1899), pp. 634–637; abs. in Chem. Centbl., 1900, I, No. 10, p. 571*).—The apparatus used in the proposed method consists of a narrow 500 cc. beaker having a siphon with stopcock on

one side and a tube with stopcock communicating with a water reservoir on the other. Five grams of soil is placed in the beaker, acidified with hydrochloric acid, and water added to within 2 cm. of the rim of the beaker. By careful heating and stirring the lighter clay particles are carried off through the siphon by means of a current of water which is made to flow through the beaker. This operation is repeated until the water passing off from the beaker becomes clear and remains clear when the contents of the beaker are heated to boiling. The method was compared with that of Schloesing, and it is claimed that it is fully as accurate and requires less time.

Pollution of natural waters and of cultivated soils by the products of gas factories, A. Lemoine (*L'Ing. Agr. Gembloux, 10 (1900), No. 9, pp. 559–572*).—This is mainly a review of investigations on the composition of the by-products (gas lime and gas liquor) of gas making and on their action on soils and natural waters.

The kaolinizing action of roots on feldspar, F. Sestini (*Landw. Vers. Stat., 54 (1900), No. 1–2, pp. 147–153*).—The author concludes that the formation of the clay of soils is not entirely due to the natural agencies to which it has heretofore been attributed, but is in part due to the decomposing action of roots and of numerous minute organisms which are found in the soil.

Some Queensland soils, J. C. Brünnich (*Queensland Agr. Jour., 6 (1900), No. 5, pp. 403–418*).—Mechanical and chemical analyses are reported of 21 samples of soil (with subsoil) from different parts of the various state farms of the Province. The soils examined are described and their reaction, weight, capacity for water, and capillary power are also stated.

Report of the geologist, E. H. Barbour (*Rpt. Nebraska State Bd. Agr. 1898, pp. 287–320, figs. 87*).—Mechanical analyses of 85 samples of Nebraska subsoils in continuation of previous work (E. S. R., 9, p. 737) are reported. These analyses were made by the Division of Soils of the U. S. Department of Agriculture.

FERTILIZERS.

Denitrification and the decomposition of animal excrement in the soil, C. Rogoyski (*Ann. Agron., 26 (1900), No. 3, pp. 121–140*).—Previous work on this subject is briefly reviewed and laboratory experiments with small amounts of various mixtures of soil (200 to 233 gm.), horse manure (40 to 41 gm.), urine (10 cc.), straw (11 gm.), and nitrate of soda (0.9 to 9 gm.) are reported. The changes which the nitrogen underwent from January 21 to June 19 and from May 13 to July 5 are recorded. The author concludes from the results that in the presence of a large amount of manure there was denitrification of the nitrates, the liberated nitrogen either escaping in the free state or being converted partially or completely into insoluble compounds. The same changes occurred when soil containing large quantities of manure or straw was fertilized with urine (or ammonia salts). The insoluble nitrogen compounds formed under these circumstances seemed to be readily nitrifiable.

The above changes did not occur when manure was added in amounts usually employed in practice, or even when added in considerably larger amounts than are usually applied, but only when excessive amounts were used. When excessive amounts are not used the author claims that the nitrates are not decomposed and the urine is nitrified.

Ground bone compared with superphosphate and Thomas phosphate as sources of phosphoric acid, U. J. MANSHOLT (*Orgaan Ver. Oudleer. Rijks. Landbouwschool, 12 (1900), No. 143, pp. 108, 109*).—Notwithstanding the claims of investigators that ground bone is inferior to other sources of phosphoric acid for fertilizers, the former remains popular with farmers, especially in England. The author thought it desirable that field experiments extending over more than one year should be undertaken in order to determine the effect of the bone meal during the second year. For such an experiment a piece of sandy loam was selected and divided into 10 parts, each 50 square meters in size. The entire field was fertilized with 250 kg. of sulphate of ammonia (20 per cent nitrogen) per hectare and 200 kg. of sulphate of potash (50 per cent K_2O) per hectare, in order to insure the presence of an abundance of nitrogen and potash. In the spring of 1898 the whole field received nitrate of soda at the rate of 300 kg. per hectare. Two of the plats received no phosphate, while to the others were applied superphosphate, Thomas slag, bone meal with the fat removed, and bone meal with the gelatin removed. In each case enough of the phosphatic fertilizer was used to make 100 kg. of phosphoric acid per hectare.

Rye was planted on all the plats in November, 1897, and in the spring of 1898 the stand was very satisfactory. The rye was harvested in August, 1898, and peas planted for the following crop. For this crop no fertilizers were used. The increase in grain for the plats receiving phosphates over those receiving no phosphates was for the 2 years as follows:

Increase in yield due to different phosphates.

	Rye.	Peas.
	Kg.	*Kg.*
Superphosphates	475	950
Thomas phosphates	600	550
Bone meal (fat removed)	375	1,250
Bone meal (gelatin removed)	750	1,600

In every case the results showed that on light soils the bone meal is in the long run equal at least to superphosphate and Thomas slag.—H. M. PIETERS.

Introduction to field experiments with fertilizers, A. L. KNISELY (*New York Cornell Sta. Bul. 179, pp. 285–318, figs. 8*).—This bulletin gives the plan and object of cooperative field experiments with fertilizers commenced under State appropriation in 1897. During the 3

years experiments have been made on 371 different farms in the State. The general results of this work are briefly discussed and the character of the work is illustrated by accounts of a few of the experiments made.

"A study of all the experiments for 3 years recorded shows that of the 3 plant foods, when used alone, nitrogen gave the largest increased yield in 26 experiments, phosphoric acid in 58 experiments, and potash in 36 experiments. This would seem to indicate that when one plant food is used alone, phosphoric acid will in most cases give the best results. When a mixture of 2 plant foods was applied, nitrogen and potash gave best results in 24 experiments, phosphoric acid and potash in 48 experiments, and nitrogen and phosphoric acid in 52 experiments. A comparison of a complete fertilizer and stable manure shows in 38 experiments the complete fertilizer gave better results, while in 54 cases stable manure produced the larger crops. These good results accompanying the use of stable manure may not be due so much to the plant food it contains as to an improvement in the physical conditions of the soil.

"In only 40 cases out of a total of 126 recorded did the complete fertilizer, a mixture of nitrate of soda, phosphate and muriate of potash, give better results than fertilizers containing one or two of the plant foods.

"These results tend to show that more often it is some especially prepared rather than a complete fertilizer that a soil requires, and that when a farmer uses commercial fertilizers he is often not following the wisest policy; he is simply 'going it blind' and possibly throwing away money."

Field tests with fertilizers on heavy clay lands, H. A. HUSTON (*Indiana Sta. Bul. 81, pp. 77-92.*)—This is an account of fertilizer experiments on tenth-acre or twentieth-acre plats on 3 farms in the State, 2 in Orange County and 1 in Monroe County. In the first two cases the soil was oak clay resting on red clay subsoil, and in the third case the soil was cold, badly drained upland clay. Mechanical analyses of one of the Orange County soils, the Monroe County soil, and the soil of the experiment station farm at Lafayette, a dark, productive loam, are given.. Corn was grown on all of the farms in 1896. The fertilizers used were nitrate of soda, 60 lbs. per acre; muriate of potash, 60 and 120 lbs., and dissolved boneblack, 230 and 250 lbs., 2 by 2 and all 3 combined; and on 1 plat in each experiment (except one) lime (1,400 and 2,800 lbs. per acre) was used in addition to the complete fertilizer. Wheat followed corn on 2 of the farms (one in Orange County and the other in Monroe County). The fertilizers used on the wheat were nitrate of soda, 74 and 148 lbs. per acre; dissolved boneblack, 124 and 248 lbs.; muriate of potash, 24 and 46 lbs., and lime, 2,800 lbs. In addition to these fertilizers, bone alone, at the rate of 200 lbs. per acre, broadcast and drilled in, and acidulated bone acid phosphate, raw bone, and steamed bone, combined with dried blood and potash, were used in the experiments in Monroe County.

The yields of the crops with the different fertilizers are reported, and the results are discussed "as illustrating how such a test may be conducted." "On all 3 farms a mixture of acid phosphate and muriate of potash in the proportion of 4 lbs. of phosphate to 1 of muriate gives

practically as good results as a mixture containing nitrate of soda in addition to these." In one experiment phosphoric acid and nitrogen appeared to be the fertilizing constituents most needed for wheat. The results of the other wheat experiment were inconclusive. Lime was in general beneficial.

The maintenance of fertility, C. E. THORNE (*Ohio Sta. Bul. 110, pp. 91, pls. 11, dgms. 8*).—This is a detailed account of field experiments with fertilizers carried on by the station from 1888 to 1899. These experiments have been reported on from time to time in the reports and bulletins of the station (E. S. R., 10, p. 949).

Nearly 900 permanent plats, mainly one-tenth acre in size, have been used. The work has been conducted at 5 different points in Ohio, viz, (1) at the experiment station at Wooster, where the soil is a yellow and somewhat sandy clay of glacial drift origin but largely modified by the soft sandy shales upon which it lies; (2) on the farm of the Ohio State University at Columbus, where the soil is a much heavier clay than that at Wooster, lying in part upon the Huron shale and in part upon alluvial gravels; (3) near East Liverpool, Columbiana County, on a thin clay underlaid by porous shale; (4) at the substation at Neapolis, about 20 miles west of Toledo, on the yellow dune sands which mark the ancient beach of Lake Erie, and (5) at a substation near Strongsville, about 12 miles southwest of Cleveland, on a cold, heavy, tenacious, white clay, underlaid by an impervious argillaceous shale (Cuyahoga shale). Mechanical and chemical analyses of 4 of these soils are reported, the mechanical structure being shown graphically. The fertilizers used have included dissolved boneblack and South Carolina and Tennessee acid phosphate, wheat bran, phosphatic slag, and bone meal being also used to some extent as sources of phosphoric acid; nitrate of soda, sulphate of ammonia, dried blood, tankage, linseed meal, muriate of potash, and barnyard manure.

"The crops employed in these tests are corn, oats, wheat, clover, timothy, and potatoes, soy beans being sometimes substituted for clover in case of failure to secure a stand of the latter crop. The cereal crops—corn, oats, and wheat—are grown both continuously and in rotation. Three rotations are in progress, one of corn, oats, and wheat, 1 year each, followed by clover and timothy, 2 years; one of potatoes, wheat, and clover, 1 year each; and one of corn, wheat, and clover, 1 year each. The fertilizers are applied altogether upon the cereal and potato crops; the clover and timothy follow as gleaners."

To secure uniformity, machinery is used wherever possible for planting, distributing fertilizer, cultivating, harvesting, etc.

The following summary of results of these experiments is given:

"On soils formed chiefly from the argillaceous shales of the Waverly series phosphoric acid is found to be the constituent of fertility first required by corn, oats, wheat, and potatoes; but the maximum yield has not been obtained until both nitrogen and potash were also added.

"When used alone, or in combination with each other only, nitrogen and potash have produced but a very small increase, and have always been thus used at a heavy financial loss.

"The complete fertilizer, containing all three constituents, has produced a much larger total increase than the sum of the increase produced by the constituents used separately.

"When the cereal crops have been grown continuously on the same land the maximum increase of crop per pound of fertilizing constituents applied has been obtained when these constituents were used in approximately the same ratio to each other in which they are found in the crop; but the total recovery of fertilizing constituents in increase of crop, under continuous cropping, has never exceeded 60 per cent of the quantity applied in the fertilizer.

"When the cereals have been grown in rotation with clover the recovery of nitrogen has, under favorable conditions, exceeded the amount applied in the fertilizer; but even under these conditions the recovery of phosphoric acid and potash has remained far below the quantity applied in the fertilizer, when maximum yields were reached.

"Thus far in these experiments the surplus nitrogen accumulated by a crop of clover, the roots only being left in the ground, has not been more than sufficient to satisfy the demands of the one crop immediately following the clover.

"At the prices at which mixed fertilizers are sold in Ohio the attempt to furnish all the nitrogen as well as all the phosphoric acid and potash required to produce increase in cereal crops grown in continuous culture, has invariably resulted in pecuniary loss, although very large increase of crop has been thus produced.

"The rotation of cereals with nitrogen-gathering crops, therefore, has been shown to be absolutely essential to the profitable use of commercial fertilizers in any form.

"The increase of crop per pound of fertilizing constituents applied has generally been smaller when barnyard manure was used as the carrier of fertility than when chemical carriers were used; but the lower cost of barnyard manure has made it possible to use this material with profit when the use of commercial fertilizers resulted in loss.

"A marked superiority is indicated from manure which has been kept under cover until required for use over that which has been exposed, even for but a short time, in an open barnyard, and it seems possible to materially increase the effectiveness of manure by treating it with nitrogen-fixing materials.

"Nitrate of soda has shown itself to be the most effective of the carriers of nitrogen employed in these experiments, with sulphate of ammonia, dried blood and linseed-oil meal following in the order named.

"Of the four carriers of phosphoric acid used, basic slag and dissolved boneblack show the highest effectiveness, with raw bone meal and acid phosphate not far below.

"The tendency to excessive production of straw in wheat and oats is apparently due in part to climatic and in part to soil conditions, and the remedy apparently lies in systematic rotation, combined with judicious selection and distribution of fertilizing materials."

Commercial fertilizers, S. W. JOHNSON, E. H. JENKINS, ET AL. (*Connecticut State Sta. Rpt. 1899, pt. 1, pp. 92*).—This includes a statement of fertilizer sales in Connecticut in 1899, the text and an abstract of the State laws relating to fertilizers, a list of manufacturers complying with the laws, notes on the sampling and collecting of fertilizers, explanations concerning the analysis and valuation of fertilizers, a review of the fertilizer market for the year ended October 31, 1899,

and tabulated analyses and valuations of 459 samples of fertilizing materials, including nitrate of soda, dried blood, cotton-seed meal, castor pomace, dry ground fish, tankage, bone, dissolved boneblack, dissolved rock phosphate, sulphate of potash, sulphate of potash and magnesia, muriate of potash, kainit, cotton-hull ashes, wood ashes, and home-mixed and factory-mixed compound fertilizers.

In 8 samples of nitrate of soda examined the nitrogen ranged from 15.52 to 16 per cent. The cost of the nitrogen per pound varied from 12.6 to 14.5 cts., averaging 13.9 cts., "a fraction of a cent higher than in the previous year." The 1 sample of dried blood examined contained 13.68 per cent of nitrogen, the nitrogen costing 13.1 cts. per pound. In 32 samples of cotton-seed meal the percentage of nitrogen ranged from 6.72 to 7.63, averaging 7.14, and the price per pound of nitrogen from 11.9 to 14.6 cts., averaging 12.9 cts., "nearly a cent and a half per pound more than last year, but still the cheapest form of quickly available organic nitrogen in our market." Seven samples of castor pomace were examined. In these the percentage of nitrogen ranged from 5 to 6.19, and the price per pound of nitrogen from 13.5 to 16.3 cts. This "is the most expensive form of organic nitrogen in the market."

The cost of available phosphoric acid in the 5 samples of dissolved boneblack analyzed ranged from 5.9 to 7 cts. per pound, averaging 6.58 cts. In 8 samples of dissolved rock phosphate the cost of available phosphoric acid ranged from 3.7 to 6.1 cts. per pound, the average being 4.6 cts.

The cost of potash in 2 samples of high-grade sulphate was about 5 cts. per pound. In 3 samples of low-grade or double sulphate of potash and magnesia the cost ranged from 5.2 to 5.9 cts. per pound. "In 7 samples of muriate of potash the cost per pound of potash ranged from 3.8 to 4.9 cts., and averaged 4.2 cts., this being the cheapest source of water-soluble potash in the market. The cost of potash in the 1 sample of kainit examined was 5.1 cts. per pound."

"Of the 117 analyses of nitrogenous superphosphates, 18 were below the manufacturer's minimum guarantee in respect of 1 ingredient and 10 in respect of 2 ingredients. Nearly one-fourth of the whole number therefore failed in some respect to come up to the claims of the manufacturer. It should be said, however, that a deficiency of 1 ingredient was sometimes attended with a marked excess of another. . . . The average cost of the nitrogenous superphosphates was $29.54; the average valuation was $19.55, and the percentage difference 51.1. . . .

"Of the 108 samples [of special manures] analyzed, 21 did not fulfill the manufacturer's minimum guarantee in respect of 1 ingredient, and 9 were each deficient in respect of 2 ingredients. Six were deficient in nitrogen, 24 in potash, and 9 in phosphoric acid. The average cost per ton of the 108 samples examined was $32.64, the valuation $21.76, and the percentage difference 50. . . .

"The average cost of the bone manures [31 samples] was $29.84 per ton; the average valuation, $22.36; showing that the station valuation was lower than was justified by the average selling price of ground raw bone in Connecticut. It must, however,

be remembered that boiled and steamed bone, quite finely ground, are put on our Connecticut market by large manufacturing establishments at prices much lower than can be quoted by our small local manufacturers for ground raw bone."

In 36 samples of cotton-hull ashes the highest percentage of water-soluble potash found was 30.94, the lowest 11.1, and the average 22.62. "Allowing 4½, 4, and 2 cts. per pound, respectively, for water-soluble, citrate-soluble, and insoluble phosphoric acid, the water-soluble potash cost from 4.2 cts. to 7.3 cts. per pound, or 6.7 cts. per pound on the average—a little less than in the previous year (7.1)."

The total and water-soluble potash were determined in 7 samples of cotton-hull ashes, with the following results:

Water-soluble and total potash in cotton-hull ashes.

Station No.	Water-soluble potash.	Total potash.	Potash insoluble in water.
	Per cent.	*Per cent.*	*Per cent.*
12444	24.34	26.92	2.58
12381	21.98	25.02	3.04
12187	21.18	24.20	3.02
12358	19.70	22.20	2.50
12319	22.90	24.18	1.28
12185	19.14	22.48	3.34
12317	20.58	25.82	5.24

Eleven samples of unleached ashes and 1 sample of leached ashes were examined. The unleached ashes included 8 samples of "Canada ashes" in which the average per cent of water-soluble potash was 4.63, of phosphoric acid 1.54, and lime 33.57.

The production of the Stassfurt deposits in 1899, MAIZIÈRES (*L'Engrais*, *15* (*1900*), *No. 23*, *pp. 540*, *541*).—The production in 1899 is given as follows (in tons of 2,200 lbs.):

Production of Stassfurt potash salts in 1899.

	Tons.
Potassium chlorid (80 per cent)	167,432
Potassium sulphate (90 per cent)	24,655
Double sulphate of potassium and magnesium (48 per cent)	8,459
Potash salts for use only as fertilizers	67,481
Kainit	1,032,506
Carnalite	63,287

The consumption of potash salts in 1899 exceeded that of the previous year by 22,000 tons of actual potash.

Commercial fertilizers, M. A. SCOVELL, A. M. PETER, and H. E. CURTIS (*Kentucky Sta. Bul. 85, pp. 79–129*).—A brief account is given of the inspection of fertilizers in Kentucky during the year 1899, with a list of fertilizer dealers complying with the law, and analyses and valuations of 406 samples of fertilizers.

"The results of the analyses show that of the 406 samples analyzed, 94, representing 56 brands and 24 firms, fell so far below the guaranteed analyses of the manufacturers in phosphoric acid, nitrogen, or potash, or any two or all three of these constituents, as to be unaccounted for by variations in sampling or analysis."

Analyses of commercial fertilizers, W. C. STUBBS (*Louisiana Stas. Bul. 58, pp. 189–264*).—This bulletin gives the text of the State fertilizer law; discusses the vari-

ous commercial sources of nitrogen, phosphoric acid, and potash, and the valuation of fertilizers; and reports analyses of 528 samples of fertilizing materials, including, besides various mixed fertilizers, acid phosphate, cotton-seed meal, tankage, dried blood, ammonium sulphate, nitrate of soda, bone meal, kainit, sulphate of potash, potassium carbonate, muriate of potash, and silicate of potash.

The treatment of dead animals and abattoir refuse with sulphuric acid, A. Pagnoul (*L'Engrais, 15 (1900), No. 25, pp. 589–591*).—The process first described by Müntz and Girard[1] is discussed with reference to its sanitary value and as a means of preserving a large amount of valuable fertilizing material which now goes to waste.

Results of fertilizer experiments with sulphate of ammonia, Kloepfer (*Fühling's Landw. Ztg., 49 (1900), Nos. 10, pp. 376–384, figs. 3; 11, pp. 396–406, figs. 3; 12, pp. 436–445, figs. 2*).—For notes on previous articles by the author on this subject see E. S. R., 10, pp. 533, 848.

Fertilizer experiments with sulphate of ammonia and nitrate of soda, Kraus (*Fühling's Landw. Ztg., 49 (1900), Nos. 6, pp. 232–237; 7, pp. 256–259*).—In 2 years' experiments with barley grown on loam soils, sulphate of ammonia and nitrate of soda gave the same increase when applied at the same time (incorporated in the soil or applied as a top-dressing at time of planting), but when the nitrate was applied at a later date it gave a greater increase than the earlier application of sulphate of ammonia.

The nitrate of soda industry in Chile, W. Newton (*Jour. Soc. Chem. Ind., 19 (1900), No. 5, pp. 408–417, figs. 8*).—This article describes the region in which the nitrate is found; discusses the causes of its formation, its composition, exploitation, and preparation for the market; and gives statistics of exportations. The exportations amounted to 1,355,360 tons in 1899, as against 1,003,340 in 1890.

Lime and its uses in agriculture, A. P. Aitken (*Jour. Jamaica Agr. Soc., 4 (1900), No. 2, pp. 87–98*).—A study of the action of lime in the soil and as a factor in plant growth.

The ashes of olive residues and their fertilizing value A. Devarda (*L'Engrais, 15 (1900), No. 22, pp. 516, 517*).

On the reversion of phosphates and notes on improvements in the fertilizer industry, W. Paysan (*Chem. Ztg., 24 (1900), No. 18, pp. 185, 186*).—Examinations of superphosphate made from Tennessee phosphate containing 79 per cent of calcium phosphate, 2.36 per cent of iron oxid, and 2.24 per cent of alumina, showed that there was practically no reversion of the phosphoric acid from the time that the superphosphate was prepared (September 2) to the time of the last examination (January 17).

On the question of the reversion of phosphates and remarks on recent progress in the fertilizer industry, von Grueber (*Chem. Ztg., 24 (1900), No. 22, pp. 227, 228*).—This article consists mainly of comments on the above article by Paysan.

The reversion of water-soluble phosphoric acid in superphosphates, C. Elschner (*Chem. Ztg., 24 (1900), No. 24, p. 252*).—Remarks on the above articles by Paysan and von Grueber. The author claims that sesquioxids combined with phosphoric acid cause reversion in superphosphates only when present in very large amounts and when the superphosphate is quickly dried. A very rapid reversion occurs, however, when the oxids are combined with silica. It is therefore combined silica and not oxids of iron and alumina which should be guarded against in the selection of phosphates for the manufacture of superphosphates.

Observations on the reversion of superphosphates, Klippert (*Chem. Ztg., 24 (1900), No. 25, pp. 265, 266*).—Remarks on the above articles.

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[1] Les Engrais, vol. 2, p. 234.

FIELD CROPS.

The influence of distance on the growth and chemical composition of plants, C. VON SEELHORST and PANAOTOVIC (*Jour. Landw.*, *47* (*1899*), *No. 4*, *pp. 379–389*).—The known effect of distance between sugar beets on their composition suggested a similar study of other plants. Oats and spring wheat were used. One, five, and eight plants, respectively, were grown in pots and observations made on the development and composition of each lot. A decrease of the ground space allotted to each plant increased the number of internodes and lessened the thickness of the culm, but increased its length. The uppermost internode was relatively and absolutely shorter, but the lowermost was longer as the thickness of the plants was increased. The length and weight of the head and the weight of the grain decreased with the reduction of ground space per plant. The spread, however, of the head increased.

The most striking change in composition was in the nitrogen content. Representing the nitrogen content of oat plants grown 1 in a pot by 100 per cent, the content of those grown 5 in a pot was 80.5 per cent, and when grown 8 in a pot, 70.1 per cent. The change in content of total ash, phosphoric acid, potash, and lime was not so great, but was nevertheless very marked.

The nutritive value of plants grown 5 in a pot was furthermore only 85.42 per cent as great as when grown 1 in a pot, and when grown 8 in a pot the nutritive value was only 76.91 per cent. The proportion of straw to grain was also increased as the distance between plants was decreased, as is a matter of common experience.

The Woburn field experiments, 1898, J. A. VOELCKER (*Jour. Roy. Agr. Soc. England*, *3. ser.*, *10* (*1899*), *pt. 4*, *pp. 585–607*).—Data in continuation of that previously noted (E. S. R., 10, p. 749) are tabulated for the yields of wheat and barley grown continuously for 22 years on the same plats, with and without manures, and of rotation experiments with barley, roots, red clover, and wheat; together with brief accounts of experiments with rye grass, alfalfa, *Lathyrus sylvestris*, pasture plats, green manuring, prevention of potato disease, and the curing of "finger-and-toe" in turnips.

Lime has proven especially valuable on the soils of the experimental fields where continuous application of fertilizers with ammonia salts has been practiced. Another effect of the lime has been to destroy spurry, a weed which was very prevalent on the unlimed plats and especially on plats fertilized with ammonia salts. The largest yield of wheat in 1898, 54.8 bu. per acre, was obtained on a plat fertilized yearly with 350 lbs. of superphosphate, and in alternate years with 200 lbs. of potash and 100 lbs. of ammonia salts (equal quantities of sulphate and muriate of ammonia). As to the influence of the manures

on the quality of wheat, nitrate of soda seemed to have the most injurious effects, much of the wheat being small and shriveled. Wheat from plats fertilized with ammonia salts was the best of all the series, being "exceedingly well grown and of good color."

The use of lime with nitrogenous fertilizers on barley had the effect of more than doubling the yield in some cases and greatly increasing it in others. It had the greatest effect when used with nitrate of soda and mineral fertilizers. The best looking crops and brightest grains were obtained where no nitrogenous manures were used. The poorest yields were obtained from plats fertilized with nitrate of soda alone.

In the rotation experiments the relative manurial value of decorticated cotton cake and maize meal was studied. With the barley crop, cotton cake gave better results than maize meal, the yield in the former case being at the rate of 33.4 bu. per acre as against 26.7 bu. in the latter. The artificial equivalent of cotton cake gave a yield of 30.4 bu. per acre as against 28.4 bu. with the artificial equivalent of maize used. The introduction of clover in the rotation had the effect of producing a very uniform stand of wheat on all the plats, and of entirely obliterating the effects of the decorticated cotton cake and maize meal. This latter fact has rendered necessary the exclusion of clover from the rotation.

Small-seeded, perennial, Italian, and annual rye grasses were sown separately in 1893 on different plats and fertilized yearly with 500 lbs. of damaged decorticated cotton-cake meal. The object of the experiment was to see how long each variety would keep its character. By 1898 the annual and perennial varieties had entirely disappeared. Considerable quantities of the Small-seeded and Italian varieties could still be found, but the plats had become so impure through the intrusion of other grasses that the experiment was discontinued.

Alfalfa was planted in 1889 on plats which had become "clover sick" through frequent seeding of clover. Annual applications of different combinations of superphosphate, sulphate of potash and ammonia, bone dust, and nitrate of soda have been made. Three or four cuttings have been obtained annually. For the first 7 years of the test the fertilizers showed no benefits, and sulphate of ammonia distinctly reduced the yield. For the years 1896–1898 a marked increase in yield occurred on plats receiving applications of sulphate of potash.

Lathyrus sylvestris, sown in 1890, has given good yields continuously, but the crop has been found useless as a feeding material, since stock do not care for it. Lime has proved a valuable fertilizer on permanent pasture lots. Tares have not been superior to mustard or rape when used as green manures. Potatoes were benefited by applications of Bordeaux mixture, even in seasons when little or no disease was present.

Field experiments, J. ATKINSON (*Iowa Sta. Bul. 45, pp. 216-229, figs. 4*).—This is a preliminary report on a system of experiments with field crops begun in 1898. Variety tests cover corn, spring wheat, oats, and barley. Shallow cultivation gave the largest yield of corn. Winter wheat is unprofitable on account of the severe winters. On mellow ground spring wheat gave a larger yield by disking corn stubble than by plowing 4 and 8 in. deep. Good results were obtained by sowing 1 lb. of rape seed per acre with oats for pasture after the oats are harvested. In order to avoid interference in harvesting the oats, it is advised to sow the rape 2 or 3 weeks later. Sowing a mixture of wheat and oats gave an increase in the total yield. Cutting back oats lessened the loss from lodging but lengthened the time of ripening. Soy beans and cowpeas, when grown at the station, did not form root nodules and the cowpeas did not ripen seed. Sorghum as a fodder plant is recommended for the State, and methods of seeding and curing and the feeding value are discussed. Brome grass (*Bromus inermis*) is considered valuable to the section, but further experiments are necessary before a definite report can be made.

In an experiment to test the shrinking of ear corn, a crib holding 7,000 lbs. of husked corn was built upon a pair of scales and weekly weighings made during 1 year. For 3 months, October to January, the loss in weight was 9 per cent; from January to April, $5\frac{4}{7}$ per cent; April to July, $3\frac{1}{7}$ per cent; July to October, $2\frac{2}{7}$ per cent. Total loss for the year, a fraction over 20 per cent.

Experiments in growing sugar beets covering 10 years indicate that the conditions in Iowa are favorable for the production of beets of superior quality for sugar making.

Results obtained in 1899 from trial plats of grain, fodder corn, field roots, and potatoes, W. SAUNDERS (*Canada Cent. Expt. Farm Bul. 34, pp. 52, figs. 2*).—Cooperative variety tests in continuation of those previously reported (E. S. R., 10, p. 1034) are recorded. The plan of the experiments has remained as heretofore. The yields of each crop obtained at the different experimental farms are tabulated. The varieties giving the largest yields at the different stations were as follows:

Oats.—American Beauty, Banner, Miller, New Zealand, Holstein Prolific, Danish Island, Black Tartarian, California Prolific, Wide Awake, Salines, Early Maine, and Poland. Average yield per acre, 81 bu. 22 lbs. *Two-rowed barley.*—French Chevalier, Danish Chevalier, Sidney, Dunham, Beaver, and Canadian Thorpe. Average yield per acre, 49 bu. 41 lbs. *Six-rowed barley.*—Argyle, Claude, Mansfield, Mansbury, Trooper, and Baxter. Average yield per acre, 52 bu. 16 lbs. *Spring wheat.*—Roumanian, Wellman Fife, Hungarian, Goose, Huron, Monarch, Preston, Rio Grande, Pringle Champlain, White Fife, Laurel, and Red Fife. Average yield per acre, 35 bu. 17 lbs. *Peas.*—Elder, German White, Picton, Carleton, White Wonder, Archer, Macoun, Chelsea, Victoria, Chancellor, King, and Nelson. Average yield per acre, 35 bu. 56 lbs. *Indian corn.*—Red Cob Ensilage, Champion White Pearl, Early Mastodon,

Angel of Midnight, Cloud Early Yellow, and Compton Early. Average yield per acre, 18 tons 485 lbs. *Turnips.*—Bangholm Selected, Perfection Swede, Halewood Bronze Top, Mammoth Clyde, Prize Purple Top, and Purple Top Swede. Average yield per acre, 32 tons 1,909 lbs. *Mangels.*—Yellow Intermediate, Ward Large Oval Shaped, Giant Yellow Intermediate, Giant Yellow Half Long, Gate Post (2nd sowing), and Lion Yellow Intermediate. Average yield per acre, 34 tons 767 lbs. *Carrots.*—Half Long White, Giant White Vosges, Improved Short White, Iverson Champion, Mammoth White Intermediate, and New White Intermediate. Average yield per acre, 24 tons 917 lbs. *Sugar beets.*—Danish Improved, Wanzlebener, Danish Red Top, and Vilmorin Improved. Average yield per acre, 24 tons 821 lbs. *Potatoes.*—American Wonder, Burnaby Seedling, Seedling No. 230, Holborn Abundance, Everett, Vanier, Empire State, Bovee, Seattle, Carman No. 1, American Giant, and Polaris. Average yield per acre, 386 bu. 40 lbs.

The average results obtained for the different crops for 4 and 5 years are also tabulated, and these data are considered to be the more valuable guide to the farmer in the selection of seed. The varieties which have given the highest averages during this period of years are as follows:

Oats.—Banner, American Beauty, Columbus, Golden Giant, Bavarian, Golden Beauty, Holstein Prolific, Early Golden Prolific, American Triumph, Abundance, White Schonen, and Wallis. Average yield per acre, 70 bu. 13 lbs. *Two-rowed barley.*—French Chevalier, Danish Chevalier, Beaver, Canadian Thorpe, Sidney, and Newton. Average yield per acre, 42 bu. 39 lbs. *Six-rowed-barley.*—Manshury, Trooper, Odessa, Oderbruch, Common, and Royal. Average yield per acre, 47 bu. 4 lbs. *Spring wheat.*—Preston, Wellman Fife, Monarch, Goose, White Fife, Rio Grande, White Connell, Red Fife, Huron, White Russian, Pringle Champlain, and Red Fern. Average yield per acre, 31 bu. 7 lbs. *Peas.*—Crown, Carleton, Pride, New Potter, King (3 years), Paragon, Mummy, Archer (3 years), Trilby, Duke, Prince Albert, and Centennial. Average yield per acre, 34 bu. 2 lbs. *Indian corn.*—Red Cob Ensilage, Selected Leaming, Thoroughbred White Flint, Giant Prolific Ensilage, Angel of Midnight, and Champion White Pearl. Average yield per acre, 17 tons 1,392 lbs. *Turnips.*—Selected Purple Top, Perfection Swede, Bangholm Selected, East Lothian, Hartley Bronze, and Jumbo. Average yield per acre, 30 tons 1,104 lbs. *Mangels.*—Yellow Intermediate, Gate Post, Giant Yellow Intermediate, Mammoth Long Red, Giant Yellow Globe, and Prize Mammoth Long Red. Average yield per acre, 31 tons 427 lbs. *Carrots.*—Improved Short White, Half Long White, Giant White Vosges, Mammoth White Intermediate, Iverson Champion, and White Belgian. Average yield per acre, 19 tons 1,719 lbs. *Sugar beets.*—Danish Improved, Red Top Sugar, Wanzlebener, and Improved Imperial. Average yield per acre, 21 tons 611 lbs. *Potatoes.*—Seedling No. 230, Irish Daisy, American Giant, American Wonder, Late Puritan, Empire State, Carman No. 1, State of Maine, Clarke No. 1, Clay Rose, New Variety No. 1, and Dreer Standard. Average yield per acre, 347 bu. 21 lbs.

Woody beets (*Deut. Landw. Presse, 26 (1899), No. 103, p. 1175*).—This article summarizes the observations made by different sugar-beet growers on the frequent occurrence of abnormal seed-bearing specimens of beets grown the same season from spring planted seed. These seed-bearing beets usually have hard woody roots of low sugar content. Freezing the young plants seems to favor the growth of the seed-bearing specimens. Rimpau experimented with 2 beds of sugar beets planted in March. One was protected at night by a light covering and the

other left exposed to frosts. In the protected bed 3.8 per cent of the plants developed into seed-bearing specimens, and in the exposed bed 7.5 per cent. Experiments with two-year-old and one-year-old seed gave 14.8 per cent of seed-bearing beets with the two-year-old seed and 9.84 per cent with the one-year-old seed. Again, 100 large seed bolls which weighed 4.23 gm. produced 6.3 per cent of seed-bearing plants while 100 small seed bolls, having a total weight of 1.42 gm., produced 16.4 per cent of seed-bearing plants. Other experiments by Rimpau showed that the deeply planted seed produced more seed-bearing plants than seed planted normally in a similarly prepared seed bed. A period of drought, excessive rain, or any weather condition which checks the growth of the beets during any stage of growth, in the opinion of the same experimenter, tends to further the development of seed-bearing specimens.

Relative to the means of reducing the number of precocious seed-bearing plants to a minimum, it is suggested that seedsmen persistently discard strains of sugar beets which tend to produce these abnormalities, notwithstanding that the form, yield, and sugar content of the beets may be all that is desired. Growers should guard against planting too early in the season and thus subjecting the young plants to the effects of frost. Deep planting should be avoided and at the last hoeing all beets growing seed should be pulled out by the roots.

The comparative yield of corn from seed of the same variety grown in different latitudes (*Arkansas Sta. Bul. 59, pp. 109-122*).— Samples of seed corn were obtained from 18 different States in 1898 and 20 in 1899 and planted in comparative plats at the station. For the purposes of the experiment seed collected north of the thirty-eighth parallel was designated as "northern grown," that collected between the thirty-eighth and thirty-fifth as "middle grown," and that south of the thirty-fifth parallel as "southern grown." Ten Northern, 7 Middle, and 3 Southern States were thus represented by the different varieties of seed. In all, 11 varieties were compared, many samples being procured of each variety. The yields obtained in the different latitudes with Leaming, Golden Beauty, Hickory King, Golden Dent, Champion White Pearl, Early Mastodon, and White Dent are tabulated and averaged. With these varieties the difference between yields of the same variety from different sources in the same latitude was sometimes greater than the average difference between varieties from different latitudes. The yields from seed of Golden Dent grown in the north latitude varied from 15.9 to 48.8 bu. per acre. Similar variations, though to a less extent, occurred with other varieties.

The average yields for two years from seed obtained from the different latitudes are shown for the varieties most uniformly represented in the different sections by the following table:

Average yields for two years of corn from different latitudes.

Name of variety.	From northern-grown seed.	From middle-grown seed.	From southern-grown seed.
	Bushels.	*Bushels.*	*Bushels.*
Leaming	20.98	26.20	17.20
Golden Beauty	32.81	45.775	50.475
Hickory King	21.855	31.81	29.10
Golden Dent	21.52	25.09	25.30
Champion White Pearl	22.62	32.00	30.10
Early Mastodon	33.54	33.75	33.45
White Dent	24.175	34.695	34.775
Average	25.785	32.76	31.485

"Thus it is seen that 75 samples of 7 varieties of corn from seed grown north of thirty-eighth parallel of latitude yielded an average of 25.78 bu. per acre; 49 samples of the same varieties from seed grown between the thirty-eighth and thirty-fifth parallel of latitude yielded an average of 32.76 bu. per acre, and 31 samples of the same varieties from seed grown south of the thirty-fifth parallel yielded an average of 31.48 bu. per acre. The middle section averaged 6.98 bu. per acre more than the northern and 1.28 bu. more than the southern section. . . .

"The results of the two years' experiments indicate that seed corn grown in the the same or nearly the same latitude as that in which it is to be planted will give the best results, and that seed grown in the neighborhood where they are to be planted are preferable to those grown farther north or farther south."

Tables showing the weather conditions from March 1 to September 30, both years of the test, are appended.

Fertilizer, culture, and variety experiments on cotton, R. J. REDDING (*Georgia Sta. Bul. 47, pp. 79–110*).—Work in continuation of that previously reported (E. S. R., 11, p. 138). The author states that the season for cotton was the most unfavorable in many years.

In 1899 25 varieties were tested. Arranged according to rank in value of yield and seed produced, Culpepper Improved stood first, followed by Texas Bur, Moss Improved, Schley, Russell Big Boll, Prize, Lee Improved No. 2, etc. Jackson Limbless stood twenty-third in the list. Moss Improved produced the largest percentage of lint, 38.3, and the smallest seeds, with the exception of one variety. Shine and King were the earliest varieties grown. The results of 6 years' tests show that early varieties are not, as a rule, the most productive.

The results obtained in the composite seed test, begun in 1898 (E. S. R., 11, p. 138), lead to the conclusion that if the seeds of two equally productive varieties, one an early and the other a late cotton, be mixed, the resulting yield will be greater than that of either planted alone.

In the distance experiments it was found that with rows 4 ft. apart the yield of cotton was greater with 1 plant every 18 in. than with 2 plants every 36 in.; also that single plants every 12 in. in the row gave larger yields than at greater distance. In rows of varying width and with plants planted at different distances in the row the yields increased in proportion as the space between plants more nearly approached a square.

The plats used in the general fertilizer tests were located on typical old upland soil. The yields obtained with different fertilizers lead to the conclusion that a formula consisting of $3\frac{1}{3}$ parts phosphoric acid, 1 part potash, and 1 part nitrogen, all in an available form, is the most suitable for middle Georgia conditions.

Fractional applications of fertilizers have not been found profitable.

Some native forage plants for alkali soils, A. NELSON (*Wyoming Sta. Bul. 42, pp. 23–45, figs. 12*).—This bulletin discusses the forage areas of Wyoming, dividing them into 3 classes—mountain, hill, and plain. The two former areas, being well drained, are reasonably free from alkali. The latter area is divided into normal plains and alkali plains. The native plants found upon the alkali plains are described and discussed. These plants are found to have a greater or less value for forage, and it is the object of this bulletin to point out the more valuable ones, and to suggest measures for increasing their yield. The salt sages are found to be the most suitable for the Wyoming lands, and 4 perennials and 3 annuals are illustrated and described. Winter Fat, related to the salt sages, Indian Millet, Slender Wheat grass, and Alkali Meadow grass, are found on the alkali plains and are of value as forage. Tuber Bulrush is found in alkali marshes and is much relished by cattle. These plants are also described.

Effect of orchards in meadows, BURKI (*Landw. Jahrb. Schweiz., 13 (1899), pp. 135–151*).—Investigations were made by the author to determine what effect on the yield and quality of grass would follow from the growing of orchard trees in meadows. Shade was the chief factor considered. The composition and yield of a large number of species of grass grown both in shade and in sunshine are tabulated. The data show that the first cutting of meadow hay was decreased on the average 32 per cent by the shade from the orchard trees, and the second cutting 59 per cent by the same cause. The decrease in yield was in general directly proportional to the nearness together of the orchard trees. Grass grown under fruit trees averaged 0.76 per cent less dry matter and 0.96 per cent less nitrogen-free extract than grass grown in the open sunlight. No marked influence of the shade on the protein content of the grass was observable except where comparatively large amounts of fertilizers were used, and then the protein content was greater in the grass grown in shade. The crude fiber and fat content was slightly higher in the grass grown in the sunshine, while the ash content was somewhat lower. Shade tended to promote the growth of orchard grass and a number of undesirable grasses, and to decrease the growth of French and English rye grass and red and white clover.

The produce of old and new varieties of oats, J. SPEIR (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 12 (1899), pp. 225–238*).—In 1898, 3 new varieties of cross-bred oats were tested in comparison with the Potato oat, an old variety grown quite extensively throughout Scotland. The yields obtained from the different varieties were

as follows: Potato, 61$\frac{3}{4}$; cross-bred varieties—Waverly 99, Tartar King 92, Pioneer 86 bu. per acre. The same varieties of oats were grown in 1899 and several other varieties, including American Beauty, were also tested. The yield of the grain and straw and the analyses with reference to the food constituents of the straw of the different varieties tested are tabulated. In general the yields in 1899 were considerably less than for the preceding year. The yields of the new cross-bred varieties fell off in amount from 57 to 58 per cent and the Potato oat 36.5 per cent. In 1899, American Beauty, with a yield of 44 bu. per acre, was the best variety grown, followed by Yellow oat 43, Waverly 42, and Abundance 40 bu. per acre.

The Irish potato, R. H. PRICE and H. NESS (*Texas Sta. Bul. 54, pp. 109–128, figs. 10*).—A continuation of the fertilizer, variety, and storage tests with potatoes previously noted (E. S. R., 9, p. 830). In addition data are given of tests made to determine the relative merits of northern and southern grown potatoes for seed and the value of different-sized pieces for planting. Potato machinery is discussed and suggestions given regarding the growing of a second crop of potatoes during the season.

Of the 33 varieties of potatoes tested Triumph has proven the best early variety grown during a period of 4 years. Red Triumph has sold better in the market than White Triumph. By planting second-crop potatoes grown in Virginia better yields were secured than with potatoes grown in New York. Tubers averaging 2$\frac{1}{2}$ oz. each, planted whole, gave larger returns than 2 or 4 oz. tubers cut to $\frac{1}{4}$ or $\frac{1}{2}$ oz. pieces.

In the fertilizer test the use of chip dirt, rotten sawdust, unfermented cotton-seed hulls, or muriate of potash has resulted in a loss in both wet and dry seasons. Both cotton-seed meal and sulphate of potash have been used with profit but the best results have been secured by the use of stall manure from cattle fed almost exclusively on cotton-seed meal and cotton-seed hulls. Scab was most abundant on the plats receiving the largest amount of nitrogenous fertilizers. It increased from 19 per cent in the case of cotton-seed meal applied broadcast to 30 per cent when the meal was applied in the furrow directly on the seed. In these experiments both cowpeas and sorghum have immediately preceded the potato crop. The different fertilizers used in these tests and the results obtained in the two seasons of 1898 and 1899 are recorded in detail. No definite conclusions are drawn and the work is considered in the nature of a report of progress.

No entirely satisfactory method has as yet been found for storing large crops of potatoes for any considerable length of time. The authors' conclusions from the results of 4 years' work along this line are as follows:

"Plant very early varieties and ship the crop just as early as it will do to harvest. If the season be dry and the markets crowded, let the crop stay in the ground about

4 weeks after maturing . . . and then harvest and market at once. . . . Some risk is run of losing the crop if a heavy soaking rain should come after the tubers mature. Grow a second crop whenever it can be grown. By spreading the tubers out on the floor of a cellar or even under the house where some light covering of straw or leaves can be placed over them, enough can be stored for family use until Christmas. Potatoes grown on well-drained sandy loam soils will keep better than those grown on stiff, heavy clay soils."

Notes on marketing potatoes and illustrated descriptions of a potato cutter, digger, sprayer, and smoothing harrow are given, together with suggestions regarding the management of first-crop potatoes for second-crop seed.

Experiments with potatoes, C. D. WOODS and J. M. BARTLETT (*Maine Sta. Bul. 57, pp. 145–158*).—Investigations were undertaken to determine the "effect of spraying potato vines with Bordeaux mixture on the starch content of the tubers. As starch accumulates most rapidly when the plant is maturing, it seemed reasonable to presume that if spraying prevented blight and prolonged the life of the plant to its natural period of growth, the tubers would be of better quality with a larger proportion of starch than those from immature plants."

Arrangements were made with growers in Aroostook County, where large starch factories are located, for samples of potatoes from sprayed and unsprayed fields. Only merchantable tubers were used. The spraying was begun late, and none of the potatoes completely escaped the attack of blight. Sixteen samples, made up of 4 varieties, were analyzed and the data with reference to both mineral and food constituents were tabulated and compared with similar data obtained from other sources. The average starch content of 3 varieties of sprayed and unsprayed potatoes is shown in the following table:

Starch content of sprayed and unsprayed potatoes.

Variety.	Sprayed.		Not sprayed.	
	Number of samples.	Average starch content.	Number of samples.	Average starch content.
		Per cent.		*Per cent.*
White Elephant	5	19.32	3	17.52
Delaware	2	18.92	2	17.45
Carmen No. 1	1	18.03	1	17.07
Average	....	19.06	....	17.43

These results indicate an average increase in starch of 1.63 per cent, seemingly due to spraying with Bordeaux mixture. With the Hebron variety the larger starch content was found in the unsprayed potatoes. This variation was attributed to the soil differences of the fields in which the 2 samples were grown.

The starch content shown by chemical analysis is compared with the estimated starch content based upon specific gravity. The figures

"show in a striking manner the unreliability of the specific gravity method of determining starch in potatoes."

A summary is given of considerable literature on fertilizing potatoes. On the basis of the chemical analysis of potatoes, the fertilizing constituents removed by a crop of 200 bu. per acre is calculated to be 37 lbs. of nitrogen, 16 lbs. of phosphoric acid, and 58 lbs. of potash. Twenty-six brands of so-called potato fertilizers were examined, and only 8 were found to resemble the above in proportion of constituents, and these contained much more phosphoric acid.

Fertilizer experiments with potatoes, B. SJOLLEMA (*Jour. Landw., 47 (1899), No. 2, pp. 105–140*).—This is a report on a series of fertilizer experiments which have extended over a period of 17 years. In a comparison of barnyard manure and chemical fertilizers, the yield was about the same on each, but the starch content of the tubers was noticeably lower in the former case, being only 14.25 per cent as against 16.15 per cent in the latter. Barnyard manure was plainly unfavorable to the fullest development of starch. This conclusion, based on experiments in which the barnyard manure and chemical fertilizers were applied to different plats, was confirmed by other experiments in which each was applied to the same plat in different seasons.

In a comparison of sulphate of ammonia and nitrate of soda as sources of nitrogen for potatoes, the yield of tubers with the former was 7.3 per cent less than with the latter. At the same time their starch content was less by 0.5 per cent. As a result, the amount of starch produced was 11 per cent less on sulphate of ammonia than on nitrate of soda. This result may probably be explained, the author suggests, by the fact that nitrate of soda is a more readily available plant food.

In a study of the influence of different kinds of manures on starch content, a complete chemical fertilizer was compared with other fertilizers identical except that either nitrogen or phosphoric acid was omitted. The complete fertilizer applied in the usual quantities produced 31,500 kg. of tubers with a starch content of 16.15 per cent. The fertilizer containing no phosphoric acid produced 28,500 kg. of tubers with a starch content of 15.05 per cent; and the fertilizer containing no nitrogen produced 27,800 kg. with a starch content of 16.45 per cent. It appears that either phosphoric acid favors the formation of starch, or that nitrogen is unfavorable to it. It was shown by other experiments that both inferences are correct; but when the application of fertilizer was doubled in each case, the complete chemical fertilizer produced a starch content of 19 per cent, the fertilizer containing no phosphoric acid 18.4 per cent, and that containing no nitrogen 18.6 per cent—that is, nitrate of soda does not materially hinder the formation of starch provided all other elements of plant food are present in sufficient quantities.

Experiments are reported which appear to lead to the conclusion that a heavy application of potash neutralizes the detrimental effect of barnyard manure on the formation of starch.

In experiments on the effect of barnyard manure and chemical fertilizers, respectively, on succeeding crops of potatoes, the effect of an application of barnyard manure was almost as marked the second season as the first, but in the third season it was very much less, and in the fourth had practically disappeared. The effect of chemical fertilizers on succeeding crops was much less marked, but when the application of commercial fertilizers was double the amount usually applied the effect on the second crop was almost as great as in the case of barnyard manure. Other considerations in the course of the experiments, however, indicate that if the application of potash alone is doubled the same result would be reached.

The effect of different elements of plant food on yield and starch content of potatoes is shown in the following table:

The effect of different fertilizing constituents on yield and starch content of potatoes.

	Increase due to potash.		Increase due to nitrogen.		Increase due to phosphoric acid.	
	In yield per hectare.	In starch content.	In yield per hectare.	In starch content.	In yield per hectare.	In starch content.
	Kg.	*Per cent.*	*Kg.*	*Per cent.*	*Kg.*	*Per cent.*
Applied alone	15,250	1.4	550	*a* 0.3	260	0.7
With potash	....	....	4,150	*a* .5	3,330	.8
With nitrogen	18,850	1.2	....	....	2,680	.7
With phosphoric acid	18,320	1.5	2,970	*a* .3	....	....
With phosphoric acid and nitrogen	19,510	1.6	....	....	....	....
With potash and phosphoric acid	....	....	4,160	*a* .2	....	....
With potash and nitrogen	....	....	....	....	3,340	1.1

a Decrease.

Potash is seen to be the most important ingredient of a potato fertilizer. Nitrogen and phosphoric acid with potash gave only a small increase in yield over potash alone, and if potash is not included in the formula there is almost no increase. Nevertheless, nitrogen and phosphoric acid are necessary complements of potash, though in small amounts or less frequent applications, for a continued application of potash alone was found to result in a decreased yield.

Soy beans, a new drought-resisting crop, H. M. COTTRELL, D. H. OTIS, and J. G. HANEY (*Kansas Sta. Bul. 92, pp. 19–28, figs. 3*).—A description is given of the plant, with directions for planting, cultivating, and harvesting. The early yellow soy bean is recommended for planting in Kansas, and it is pointed out that some reported failures have been by reason of planting a late-maturing kind. Planting should be done after danger of frost is past, and cultivation should be shallow and level. The crop should be harvested when the pods turn brown and before the beans are wholly ripe. In harvesting, a knife attached to a cultivator and running just below the surface is recommended.

The threshing may be done with an ordinary grain separator by using blank concaves. The yield in Kansas is from 10 to 20 bu. per acre, and the cost of production varies from 40 to 55 cts. per bu.

The feeding value of soy beans is discussed, and 5 tests with pigs are briefly reported in which soy beans were compared with Kafir corn and corn meal. The experiments made show a saving by a mixed ration with corn or Kafir corn in fattening hogs of from 13 to 37 per cent per 100 lbs. of gain.

From the results of 10 years' experience at the station the author concludes that the soy bean is a profitable crop for the Kansas farmer. "It stands drought as well as Kafir corn or sorghum; it is not touched by chinch bugs; the grain is a richer feed than linseed meal, and the plant enriches the soil in which it is grown."

Alfalfa, G. L. CLOTHIER (*Kansas State Bd. Agr. Quart. Rpt. 1900, Mar. 31, pp. 7–39, figs. 11*).—The history, culture, and feeding value of the plant, compiled from the work of the agricultural experiment stations are given.

Distance experiment with corn, C. D. SMITH (*Michigan Sta. Rpt. 1899, p. 58*).—In a test of growing corn in drills and hills in rows different distances apart, the best results were obtained when the rows were fully 3½ ft. apart, "either in hills equally distant or in continuous rows, the kernels being between 6 and 9 in. apart in the row."

Cotton, K. SUPF (*Tropenpflanzer, 4 (1900), No. 6, pp. 263–276*).—Statistics of growth and manufacture of cotton, with colored maps showing area of world's production.

Kafir corn, J. G. HANEY (*Kansas State Bd. Agr. Quart. Rpt. 1900, Mar. 31, pp. 52–65, figs. 2*).—History, cultural notes, and feeding value, compiled from various sources.

Culture of white lupines, P. P. DEHÉRAIN and E. DEMOUSSY (*Ann. Agron., 26 (1900), No. 2, pp. 57–77, figs. 4*).—White lupines were grown in pot and field experiments on calcareous soils well supplied with mineral elements. The results are given in detail and seem to demonstrate that without the presence of nodules on the roots of these plants growth is feeble and uncertain and premature death is frequent. At least 4 different sorts of bacteria form nodules on the roots of white lupines, but not all are equally efficient in furnishing nitrogen to the plant. It is owing to this difference in efficiency, rather than to the composition of the soil, that white lupines do not flourish in different districts equally well.

Tests of the value of seeds of first and second flowering, E. GAIN (*Sta. Agron. Nancy, Bul. 2, 1900, pp. 42–46*).—White lupine seed were selected from pods of the first and second flowering periods, respectively, and planted under similar conditions of soil and culture. From 33 to 50 per cent of the seeds from the second flowering failed to grow, and those that did live made a weak growth, the yield of pods and seed and total weight of the plants being scarce 50 per cent of that of the seeds obtained from the pods of the first flowering. Ordinarily the seeds of the different flowering periods are all harvested together. The undesirability of using such mixed seeds, as shown in this experiment, is commented upon.

Meadows of the lower course of the Saone, H. CORNET and E. DELORME (*Ann. Agron., 26 (1900), No. 3, pp. 140–155*).

When and how potatoes were introduced into Norway, O. OLAFSEN (*Tidsskr. Norske Landbr., 6 (1899), No. 11, pp. 504–506*).

Cultivation of the potato, A. C. TONNELIER (*El cultivo de la papa. Buenos Ayres: J. Peuser, 1899, pp. 22*).

The starch yield of different varieties of potatoes (*Deut. Landw. Presse, 27 (1900), No. 36, p. 443*).—The total starch content and the yield of first and second class product obtainable from each of 11 varieties of potatoes are reported.

Influence of the size of the potato vines on the yield, C. VON SEELHORST (*Jour. Landw., 48 (1900), No. 2, pp. 97–103; Deut. Landw. Presse, 27 (1900), No. 40, pp. 500, 501*).—The author's experiments in the selection of potatoes for seed show that large vines tend to give large yields, and that this character is to a certain degree inherited.

Trials with potatoes, F. DESPREZ (*Semaine Agr., 20 (1900), Nos. 981, pp. 68, 69; 988, pp. 126, 127*).—Blue Giant and Richter Imperator have proven the hardiest and most satisfactory varieties tested for 9 years. Notes on a number of other varieties grown are given, together with tabular matter as to yield, etc.

Report on experiments at the German potato culture station in 1899 (*Sächs. Landw. Ztschr., 48 (1900), No. 9, pp. 88–93*).—Richter Imperator and Dabersche have given the most satisfactory results of a number of varieties tested for a period of years.

Monograph on rice, C. D. GIROLA (*Monografía del arroz. Buenos Ayres: J. Peuser, 1899, pp. 63, figs. 5*).

Rice, C. D. GIROLA (*Bol. Soc. Nac. Agr. [Lima] 4. ser., 1900, No. 8, pp. 373–411, figs. 2*).—A popular article on varieties, culture, enemies, etc.

Sugar beets in Sanpete and Sevier counties, L. FOSTER (*Utah Sta. Bul. 63, pp. 22*).—Results of cooperative experiments in these counties, with cultural suggestions and a discussion of factory conditions. The average sugar content of the beets grown in the 2 counties in 1899 was 15.72 per cent; purity, 82.01 per cent. Tables of analyses of beets grown in the years 1897 to 1899 in Sanpete, Sevier, Utah, and Weber counties are included in the bulletin.

Wholesale sugar-beet seed production in Germany, E. SCHAAF (*Bl. Zuckerrübenbau, 7 (1900), Nos. 3, pp. 33–37; 4, pp. 49–57; 5, pp. 65–71; 6, pp. 81–88*).

The wheat crop of California (*Sci. Amer., 83 (1900), No. 1, p. 9*).—A description of the lands, culture, and storing, with especial reference to the machinery operated by steam power.

Macaroni wheats, G. VALDER (*Agr. Gaz. New South Wales, 11 (1900), No. 3, pp. 210–212, figs. 5*).—Several varieties of these wheats have been successfully grown at the Hawkesbury Agricultural College. The uses of these wheats for green fodder, hay, and for macaroni are noted.

HORTICULTURE.

Forcing tomatoes, A. T. JORDAN (*New Jersey Stas. Bul. 141, pp. 18*).—The author describes the methods generally observed in New Jersey in growing tomatoes under glass, and presents the detailed results of his investigations of problems connected with forcing tomatoes.

Thickness of setting (pp. 6–8).—Tomato plants were allowed $1\frac{1}{2}$, 2, $2\frac{1}{2}$, 3, and $3\frac{1}{2}$ sq. ft. of bench surface per plant. Four crops were grown. In order to admit light and permit of a better circulation of air about the plants, it was found necessary to clip the leaves of plants given $1\frac{1}{2}$, 2, and $2\frac{1}{2}$ sq. ft. of space. Watering with liquid manure was practiced. The best results were obtained from the plants given the greatest number of applications. The maximum yield per plant was from the plants having $2\frac{1}{2}$ sq. ft. of surface, but the maximum yield per square foot of

bench space (28.5 oz.) was obtained when the plants occupied 2 sq. ft. of bench. Plants given 1½ sq. ft. of bench stood second in yield, but when thus closely crowded together too severe pruning was required to give satisfactory results.

Fertilizers with surface v. subwatering (pp. 8–10).—The soil used was a clay loam, to which 3 per cent of peat moss was added. In two instances regular forcing soil was used for comparison, and in two others sifted coal ashes, to which 3 per cent of peat moss was added. Like amounts of mineral fertilizers (a mixture of 200 lbs. muriate of potash and 350 lbs. acid phosphate per acre) were used on each plat. Liquid manure was applied to the plats in some instances. Plats were duplicated, one series being surface-watered and the other subwatered. The yields obtained on the different soils by the different methods of manuring and watering are shown in tabular form. The results obtained are summarized by the author as follows:

"In 5 of 7 plats subwatering has increased the yield—in one case nearly 50 per cent (49.22), and averaging for the 5, 31.13 per cent.

"Relatively, the increase caused by subwatering has been greater upon the nitrate plat, the percentages of increase being for the nitrate 49.22, as against 46 for the sulphate, 39.15 for blood, 36.79 on the forcing soil, and 4.7 on the ashes. Upon the soils used yard manure as a source of nitrogen is superior to the commercial forms applied, *i. e.*, nitrate of soda, sulphate of ammonia, and dried blood. The increase over nitrate of soda under identical conditions was 5.11 oz. per square foot.

"As a result of 4 crops without renewal of soil, sifted coal ashes with 3 per cent peat, fed with a complete chemical fertilizer, has given, where surface watered, a yield exceeding any other by 3.89 oz. per square foot, and under subwatering is second only to the regular forcing soil."

The effect of varying amounts of nitrogen on different soils (pp. 10–13).—Tomato plants were grown in boxes 18 in. square and 12 in. deep, filled with either nearly pure sand, sandy soil, or clay soil. Three boxes of each soil received mineral fertilizers (potash and phosphoric acid) only, 3 mineral fertilizers plus 160 lbs. of nitrate of soda, and 3 mineral fertilizers plus 320 lbs. of nitrate of soda.

Lorillard and Chemin varieties of tomatoes were grown. With nearly pure sand the yield obtained with the smaller application of nitrate was nearly 5 times as great as that obtained where minerals only were employed. On the sandy soil the yield was nearly double, and on the clay soil a little more than double as great. The increase in yield per box due to the larger application of the nitrate on the different soils was as follows: Nearly pure sand, 43.18 per cent; sandy soil, 58 per cent, and clay soil, 19.7 per cent. These results are considered as varying in every respect from the results previously obtained under field conditions.

Boxes and pots v. benches for forcing tomatoes (pp. 13, 14).—The boxes used were similar to those described above. The pots were ordinary 10-inch pots, holding approximately 0.3 cu. ft. of soil. Plants

on the benches had approximately 1½ sq. ft. of bench space. The soil, varieties, methods of training, handling, pruning, manuring, etc., were the same in each case.

"The lot grown on benches has given the largest total yield and yield for space occupied, but has given the lowest average weight per fruit. Those grown in pots have given almost as large a yield for the space occupied and the largest average weight per fruit. This large yield is probably due, in part at least, to the fact that the pots were set in the extreme south end of the bench, and thus had the full advantage of the light. Placing each lot upon the same basis as to amount of soil, these results might be changed. However, the smaller quantities of soil dry out quickly, and consequently require very close attention. We much prefer the use of benches."

Single-stem v. three-stem training (pp. 14, 15).—Nine plants were grown under similar conditions. Six were trained to single stems and 3 to 3 stems. The average weight of fruits grown on the single stems was 3.98 oz., and the yield per square foot of bench space 48.77 oz. With plants trained to 3 stems the average weight of the fruits was 4.07 oz., and the yield per square foot of bench space 38.77 oz. The claim that 1 plant trained to 3 stems will occupy no more room than 2 plants trained to single stems was not borne out in these experiments. The results lead the author to recommend the single-stem method of training for forcing tomatoes.

Financial considerations involved in forcing tomatoes are considered. Based on the yields per square foot of bench in these experiments (24.23 oz. salable fruit) and the prices obtained for tomatoes during the 2 seasons 1898 and 1899 (67.5 cts. per square foot of bench for 2 crops), the author calculates the value of the crops from a house 20 by 100 ft. to be $972 a year, which, after deducting the cost of coal and labor, leaves a profit of $693.50.

In these experiments tomato blight (*Cladosporium fulvum*) was held in check by a mixture of 6 lbs. of copper sulphate, 4 lbs. of lime, and 90 gal. of water. Tobacco smoke was successfully used in controlling the white fly (*Aleyrodes vaporariorum*).

Pear growing in New Jersey, A. T. JORDAN (*New Jersey Stas. Bul. 142, pp. 14*).—The discussion of this subject is based largely on data obtained from the fruit survey of the State made in 1895 (E. S. R., 8, p. 887). The subjects concerned are soils, varieties, purchasing stock, planting, cultivating, manuring, pruning, thinning, life of pear orchards, insects and diseases, picking and marketing, yields, expenses, and profits.

At the present time pears in New Jersey rank third in commercial importance among orchard fruits. Keiffer and Bartlett are the leading varieties. The average yield of orchards in 1898 was 68.2, and in 1899, 99.4 bbls. per acre. Some 5,650 acres in the State are devoted to pear culture. The net receipts vary from $25 to $950 per acre, and average $256.45 per acre.

"Plowing early in May and keeping the soil well stirred through the season, ending with the sowing of crimson clover in August for the winter cover crop, is the practice of the best growers. Two good mixtures of fertilizers to apply are (1) equal parts of ground bone, muriate of potash, and acid phosphate; and (2) $1\frac{1}{2}$ parts of ground bone and 1 part of muriate of potash; 500 lbs. per acre is usually applied. Where nitrogen is needed, nitrate of soda is one of the best forms, but may be omitted when crimson clover is grown.

"[Pruning before the buds start and later thinning of the fruit is recommended.] Fire blight and leaf blight are the two worst diseases. In the early stages of the first, cut well below the injury and burn. If well started or into the body of the tree, destroy it completely. Spraying will control the second.

"With good trees and proper varieties to begin with and careful attention to details, as outlined, good returns may be confidently expected from the culture of the pear."

Observations and suggestions on the root killing of fruit trees, J. Craig (*Iowa Sta. Bul. 44, pp. 179–213, figs. 9*).—This bulletin gives a review of the root killing of fruit trees in the State and the work of the station thereon, supplemented with notes from nurserymen and others. The work covers especially the freeze of February, 1899, when the losses were very heavy. Young apple trees under 5 years suffered more than older stock. The effect was worse on sandy soils not covered with vegetation. The losses with plums emphasized the value of American stocks. The only grapes exempt from injury were the pure or half blood natives.

To overcome injury to nursery stock severe heading back with apples gave the best results, and with plums cutting trees back to straight sticks 2 or 3 ft. in height. It was noticed that there was an effort on the part of trees to recover by throwing out roots from the scion, especially where the stock had been killed. It was found that banking young apple trees with earth aided this effort. In the case of nursery stock, however, it is advised in 9 cases out of 10 to dig up and burn injured trees. Nurserymen are advised to use hardy stock in grafting.

There is appended a table of information from 62 leading fruit growers of the State on the subject of root killing by cold. From a canvass of the whole field, the writer concludes that the lack of a protecting blanket of snow coincident with unusually severe cold was the chief cause of the great losses by root killing, and that the amount of loss bore a direct relation to the severity of the frost. Trees suffered most on clean soils and on exposed dry knolls with northern aspects. To obviate root killing the writer recommends cover crops, preferably mammoth red clover or hairy vetch; the use of congenial and hardy stocks for grafts; and, on soil well drained, deep planting.

Coffee grafting—some results heretofore obtained and its future importance, J. G. Kramers (*Teysmannia, 10 (1899), No. 11, pp. 535–568*).—The author gives an outline of the history of efforts made to graft Java coffee on hardy Liberia stocks for the purpose of resisting the attacks of nematodes, points out some reasons for success or

failure, and describes the 2 methods that have so far been most successful. The coffee tree is difficult to graft. It wilts easily, and if all the conditions are not favorable a good union is not formed. Although some of the scions usually live, the percentage by the old method has been too small to make such grafting an economic success.

The system of grafting by approach of 2 seedlings in the cotyledonary method has given good results. By this method one cotyledon with a portion of the epidermis of the hypocotyl is cut away from the Liberia seedling and a portion of the epidermis between the 2 cotyledons is removed from the Java seedling. The two are then brought together at the cut surfaces, carefully tied up, and replanted. After a few weeks the remaining cotyledon and the plumule are cut away from the Liberia seedling, and later the hypocotyl of the Java seedling is severed.

The other method recommended is similar to that often used in grafting conifers. The scion of the Java or other desirable variety is inserted into the terminal bud on a branch of the Liberia. The wound is carefully covered and the young shoot protected so as to prevent transpiration as far as possible during the time that the union between scion and stock is taking place.

In the course of his work the author had occasion to examine the roots of a number of grafted Liberias of different ages, and in almost all cases found them free from nematodes. The few cases in which nematodes were found were on diseased trees, and it seemed probable that the parasite had effected a lodging on account of the diseased condition rather than that it had caused the disease.—H. M. PIETERS.

Strawberry notes for 1899, A. L. QUAINTANCE (*Georgia Sta. Bul. 48, pp. 147–173, pls. 6, figs. 5*).—Details of tests of varieties, methods of treatment in the row, and trials of fertilizers form the basis of these notes. Similar work at the station has been previously reported (E. S. R., 8, p. 785).

Tables showing the yield at different dates of picking are given for 60 varieties tested in 1899. Beder Wood stood first in total yield of early fruit; Lady Thompson second in the amount of early fruit. Lady Thompson is considered a good variety for either local or distant markets. Seventeen of the varieties not previously tested at the station are described.

In a comparative test of growing strawberries in hills and in matted rows 12, 18, and 24 in. wide and 4 ft. apart, it was found that the yields increased with the width of the matted rows. The yield obtained on the plats planted in hills was scarcely more than one-third of that obtained in matted-row culture. The 18 in. matted rows gave a yield of 134.5 qts. per acre over the 12 in. rows, and the 24 in. matted rows 282 qts. per acre over the 18 in. rows. The author believes, however, that the 18 in. matted rows will give the maximum yield

consistent with cheapness of cultivation since the space left between the 24 in. rows is too narrow for cultivation with the ordinary implements.

The effects of doubling and in some instances quadrupling the essential fertilizer elements in a normal formula, analyzing 8 per cent of phosphoric acid, 8 per cent of potash, and 4 per cent of nitrogen, and in substituting cotton-seed meal for nitrate of soda, and kainit for muriate of potash in the normal formula were studied. The results are given in tabular form. Substitution of kainit for muriate of potash resulted in an increased yield of 594 qts. per acre. Doubling or quadrupling the amount of kainit used in the normal formula decreased the yields. Doubling the amount of nitrate of soda in the normal formula was not financially profitable. When the normal formula was supplemented in the spring by a dressing of nitrate of soda, the yield was increased by about 200 qts. per acre. The substitution of cotton-seed meal for nitrate of soda resulted in considerably decreased yields.

Cultural directions reprinted from Bulletin 32 of the Station (E. S. R., 8, p. 785) are appended.

The absorption of water by orchids, R. G. LEAVITT and R. M. GRAY (*Amer. Gard., 21 (1900), Nos. 271, pp. 148, 149; 272, pp. 168, 169; 273, p. 186; 274, pp. 206, 207, fig. 1*).—The authors made investigations to determine which of the vegetative parts of orchids—leaves, bulbs, stems, bulb scales and roots—are capable of absorbing water, and whether in liquid or gaseous form.

Leaves of 20 species of orchids were plunged under both warm and cold water and also sprayed in imitation of rain. The experiments were performed in light and in darkness and the submergence lasted from 2 to 6 days. Change in weight was determined by weighing on delicate scales. With thick-leaved species, absolutely no absorption of water took place, however long the submergence. With 6 of the more herbaceous sorts, a slight increase took place after 2 days' submergence, but this was thought to be due to imperfections, such as fungus spots, since when these perforations were sealed with vaseline no further increase in weight took place. Pseudo-bulbs and bulb scales surrounded by wet wrappings of filter paper or cotton or plunged under water failed to absorb appreciable amounts of water. In a similar manner when leaves, pseudo-bulbs, and bulbous stems were exposed in a closed receptacle having an atmosphere nearly saturated with water vapor, no increase whatever but instead a decrease in weight followed in every instance. From these results the authors conclude that "leaves and stems do not function as organs for the absorption of water in any form."

Theories of well-known botanists regarding the absorption of water by orchids are noted in some detail.

In one experiment with orchid roots the roots were kept in a box where the atmosphere had a nearly constant water-vapor-saturation content of 95 per cent. "The cut ends of the roots were generally sealed. The roots were sometimes partially dried out before exposure in the box, and sometimes taken from unwatered plants and put into the box directly. The trials lasted from 2 to 4 days, but in several cases much longer." Roots from 24 species were used in the test. The roots continually decreased in weight and finally shriveled and died, thus showing that water vapor was not taken up, though present in more copious amounts than usually occur in nature. "Other roots taken from the same plants at the same time and kept in the same box but supplied with liquid water remained green, plump, and vigorous, long after the first were quite dead. This shows that death came from lack of water, not from being severed from the plant."

Plants hung in the greenhouse, where the humidity rarely if ever went below 80 per cent, and not watered for 2 months, produced new shoots and new roots but steadily decreased in weight. In another test, where the water evaporated by the leaves and stem of an orchid was absorbed by calcium chlorid while the roots were kept in a damp box having a humidity saturation of 95 per cent, the orchids constantly lost in weight through the roots, and the plants drooped for want of water.

The results obtained in these experiments are believed to show that if water absorption by aerial roots takes place at all the function is of minor importance.

Report of Beeville Station on cabbage and cauliflower, B. C. PITTUCK and S. A. MCHENRY (*Texas Sta. Bul. 52, pp. 42–52*).—Notes on the germination, growth, yield, character, and quality of 35 varieties of cabbage and 8 varieties of cauliflower. From the results of repeated tests the following varieties of cabbage are recommended, in the decreasing order of their importance:

Early varieties.—Early Jersey Wakefield, Early Winningstadt, Maule Winningstadt. *Medium early varieties.*—Improved Early Summer, Chase Early, Stein Early Flat Dutch, Fottler Short Stem, Danish Ball Head. *Late varieties.*—Lauderback All Year, Autumn King, Burpee Sure Head, Frotscher Superior Large Late Flat Dutch, St. Denis (small), French Market (medium size), Crescent City Large Flat Dutch.

The following early varieties of cauliflower, suited to the southwest section of Texas, are recommended: Le Normand Short Stem, and Henderson Early Snowball; for late planting, Late Italian Giant.

Bermuda onions (*Amer. Gard., 21 (1900), No. 282, p. 343, fig. 1*).—Descriptive of the growing and marketing of Bermuda onions. The land is enriched with well rotted cow or pig manure. The seed is sown in September and the crop harvested from January to May. A rigid system of inspection covers all shipments to the United States.

Nitrate of soda in vegetable culture, ROMBAUT and SIMON (*Belg. Hort. et Agr., 12 (1900), Nos. 2, pp. 21, 22; 3, pp. 38, 39*).—Effect of nitrate of soda on the production of potatoes, rhubarb, and tomatoes.

Market gardening, H. R. KINNEY (*Massachusetts State Bd. Agr. Rpt. 1899, pp. 86–112*).—Suggestive and practical paper on market gardening, dealing with hotbeds, vegetable-storage cellar, soils, manures, and the culture of different vegetables.

The home fruit garden, F. A. WAUGH (*Vermont Sta. Bul. 74, pp. 89–97*).—Popular directions for the location, preparation of the soil, planting, and tending of the various orchard and small fruits which go to make up a home fruit garden.

Second report on Arkansas seedling apples, J. T. STINSON (*Arkansas Sta. Bul. 60, pp. 123–134, figs. 4*).—The writer gives the results of further study of Arkansas seedlings, a continuation of work previously reported (E. S. R., 10, p. 48). Twenty-five varieties are described and characteristics noted. An effort is made to straighten the nomenclature of the apples noted and their value as new economic varieties is discussed.

The curing of apricots, J. B. NEFF (*California Fruit Grower, 25 (1900), No. 629, p. 4*).—A paper read before the Pomological Society of Southern California.

Check list of hybrid plums, F. A. WAUGH (*Vermont Sta. Bul. 75, pp. 101–110*).—This check list has been prepared particularly for the use of nurserymen and cataloguers. It contains as far as possible the following data respecting each of the 65 varieties noted: Name, original publication of the same, Vermont publications concerning it, certain facts relative to its origin and introduction, and its parentage.

Fruit list for Virginia, W. B. ALWOOD (*Virginia Sta. Bul. 98, pp. 41–49*).—This is a compiled list based on the personal observations of the author, and supplemented by a consensus of the best experience gathered from State growers. It includes such old standard varieties and promising newer sorts as it is thought will be of value for planting orchards throughout the State. The list includes 17 varieties of apples, 11 pears, 4 quinces, 21 peaches, 12 plums, 10 cherries, 3 blackberries, 6 raspberries, 5 currants, 3 gooseberries, 11 strawberries, and 12 varieties of grapes.

Strawberries, C. C. NEWMAN (*South Carolina Sta. Bul. 49, pp. 27, pls. 7*).—This is a popular bulletin on growing strawberries. The questions discussed are sexuality, selection, planting, cultivation, and mulching. Ninety-five varietes were tested at the station during the season. A list is given of varieties suited to the locality and a list of the varieties not promising for the section. Photographic reproductions are given of the berries of 36 varieties. The following 6 have proven the best all-round berries tested: Haverland, Brandywine, West Lawn, Lady Thompson, Bismarck, and Bubach.

Resistant vines and vineyards in California, G. HUSSMANN (*California Fruit Grower, 25 (1900), No. 633, p. 5*).—A consideration of varieties least affected by phylloxera and of vineyard and bench grafting. Vineyard grafting is considered cheaper and more satisfactory than bench grafting.

The wholesale grape nursery; complete directions for the work connected therewith, R. SPÖRR (*Die Rebenschule im Grossbetriebe, eine ausführliche Beschreibung sämmtlicher in der Rebenschule vorkommenden Arbeiten. Vienna and Leipsic: A. Hartleben, 1900, pp. 139, figs. 55*).—The author describes in a thorough manner all the details involved in the growing of grape nursery stock on a wholesale scale. Discussions as to the theory of grafting, methods of grafting and the growing of vines by grafts, roots, and American cuttings occupy the larger part of the work. Chapters on grape houses, grafting and packing rooms, and on grape nursery bookkeeping conclude the book.

American vines; their adaptation, culture, grafting, and propagation, P. VIALA and L. RAVAZ (*Melbourne: F. W. Niven & Co., 1899, pp. 88*).—This is a translated abridgment of the second French edition by W. P. Wilkinson and Joseph Gassies.

The influence of precipitation and fertilizers on the yield of grapes, B. CHAUZIT (*Messager Agr. Midi, 1900, I, No. 2, pp. 50, 51*).

Future of our wine industry and the results of manuring vineyards in Europe and Australia, F. E. H. W. KRICHAUFF (*Adelaide, 1899, pp. 36*).

Reconstruction of vineyards, L. RAVAZ (*Reconstitution du vignoble. Paris: G. Masson, pp. 148, figs. 31*).—Chapters are given on conditions which influence the growth of vines, as climate and soil; the species and varieties of American vines.

descriptions of all the more important being given; methods of vine reproduction as by buds, cuttings, grafts, etc., with notes on grape-nursery management; and on the establishment of a vineyard.

Culture of vanilla (*Bol. Soc. Agr. Mexicana, 24 (1900), No. 21, pp. 415–417*).—A description of the plant, its culture, and preparation for market.

Vanilla (*Bul. Bot. Dept. Jamaica, n. ser., 7 (1900), No. 3–5, pp. 45–51*).—Cultural instructions with outlines of the methods of curing the fruit followed in Guiana, Peru, Mexico, and Réunion.

The cultivation and uses of rosella, D. JONES (*Queensland Agr. Jour., 6 (1900), No. 5, pp. 371–375, figs. 2*).—Popular directions for the culture and utilization of this fruit (*Hibiscus sabdariffa*).

Gutta-percha, E. OBACH (*Die Guttapercha. Dresden: Steinkopff & Springer, 1899, pp. 114, figs. 61*).—The author discusses the history, botany, culture, geographical distribution, and composition of gutta-percha; describes the processes employed in the purification of the raw material; and gives the chemical composition, physical and mechanical properties, uses, consumption in England, substitutes, relation to oxygen and ozone, and methods of preservation of purified gutta-percha.

Florists' manual, W. SCOTT (*Chicago: Florists' Pub. Co., 1899, pp. 235, figs. 225*).—This is a reference book for commercial florists. It treats alphabetically of the character, culture, and handling of all greenhouse plants of commercial importance and of all subjects, such as greenhouse building, packing plants, decorations, fungicides and insecticides, soils, potting, etc., pertaining thereto. The book is well illustrated, and is intended as a reference book and guide for all florists not specialists.

Comparative study of 34 varieties of Italian cannas, E. ANDRÉ (*Rev. Hort., 72 (1900), No. 10, pp. 258–261, figs. 2*).

Origin and amelioration of the garden gladioli (*Florists' Exchange, 12 (1900), No. 25, pp. 628, 629*).—History of the plant and of its improvement.

Culture of water lilies and aquatics, P. HENDERSON (*New York: P. Henderson & Co., [n. d.], pp. 41, figs. 21*).—This is a reprint from the author's "Gardening for Pleasure."

Nomenclature of all the known roses with indications as to their race, originator, year of production, color, and synonyms, L. SIMON and P. COCHET (*Nomenclature de tous les noms de roses connus, avec indications de leurs race, obtenneur, année de production, couleur, et synonymes. Metz: A. Béha, 1899, pp. 187*).

American greenhouse construction and cut-flower production (*Möller's Deut. Gart. Ztg., 13 (1900), Nos. 3, pp. 28–32, figs. 8; 5, pp. 50, 51, figs. 8; 6, p. 62, figs. 4; 7, pp. 88–90, figs. 4; 10, pp. 108–110, figs. 7*).

Ornamental shrubs, L. D. DAVIS (*New York: G. P. Putnam's Sons, 1899, pp. 338, figs. 107*).—This book discusses "ornamental shrubs for garden, lawn, and park planting, with an account of the origin, capabilities, and adaptations of the numerous species and varieties, native and foreign, and especially of the new and rarer sorts suited to cultivation in the United States." It is not designed as a scientific treatise, but is written more especially for those interested in plants and flowers who may have no knowledge of botany.

FORESTRY.

Tree planting in Utah, U. P. HEDRICK (*Utah Sta. Bul. 62, pp. 215–260, pls. 2, figs 12*).—In this bulletin an account is given of the behavior of 40 species of timber and shade trees now growing on the grounds of the station. The experiment was begun in the spring of 1890, with the object of testing the adaptability of various species of trees to that region, and of demonstrating the best method of planting

and caring for them. In addition to this experiment the station is conducting, in cooperation with the Division of Forestry of this Department, experiments in tree planting to ascertain the adaptability of the principal economic species to the plains.

The annual precipitation and temperatures are given for the State, and a general statement made concerning the method of planting and the condition of trees of each of the forest species. The planting, cultivation, and irrigation was about the same as would be given an orchard, except that the cultivation ceased with the sixth summer.

The species tested are described at length, and their relative adaptability and behavior are described. Among the more promising trees for that region (as shown by the results of 9 years' experiments), with their height and circumference, are the following:

Average growth of forest trees for nine years.

	Height.	Circumference.
	Feet.	*Inches.*
Populus deltoides	39	40
Populus alba bolleana	43	29
Populus nigra italica	46	40
Populus alba nivea	30	40
Populus tremuloides	36	23.5
Populus balsamifera intermedia	37	29
Populus laurifolia	40	41.5
Salix laurifolia	25	18
Salix fragilis	20	18
Juglans nigra	20	15
Juglans cinerea	18	13.5
Ailanthus glandulosa	16	14.5
Catalpa speciosa	18	22
Betula papyrifera	18	13.25
Alnus glutinosa	22	21.5
Ulmus americana	24	21.75
Platanus occidentalis	17	13
Acer saccharum	23	15
Acer saccharinum	24	13
Acer negundo	35	40
Robinia pseudacacia	23	22
Gleditschia triacanthos	21.5	19
Tilia europæa	19	15
Morus alba tartarica	22	18
Pinus strobus	14	12
Pinus sylvestris	18	16
Picea pungens	15	12
Picea excelsa	13	11.5
Picea canadensis	8	10.5

Fertilizers in the culture of osier willows, P. WAGNER (*L'Engrais, 15 (1900), No. 11, pp. 254, 255*).—A series of experiments with various fertilizers is reported, showing that the growth of osiers can be greatly promoted by means of liberal manuring. The product was trebled by the application of 1,650 lbs. of phosphatic slag and 550 lbs. of nitrate of soda per acre. With the same amounts of slag and nitrate of soda combined with 660 lbs. of a 40 per cent potash salt the yield was quadrupled.

The trees of Vermont, ANNA M. CLARK ET AL. (*Vermont Sta. Bul. 73, pp. 33–86, figs. 58*).—This bulletin is introduced by the following statements:

"The following account aims to include the native and spontaneous trees of the State, together with brief mention of such others as are commonly cultivated. It

is primarily addressed to readers who have little or no botanical training, but who may wish to learn the names of the trees and the characters by which they may be recognized, as well as the main facts as to their occurrence and distribution in the State. . . . It is especially to the children of Vermont, and to the teachers of these children, either at home or in school, that it is hoped this publication will prove most interesting and most useful."

The bulletin contains descriptions of 97 species, representing 18 families. Each species is illustrated by original drawings.

Drawings of the forest trees of Japan, H. SHIRASAWA (*Iconographie des essences forestières du Japon. Tokyo: Minister of Agriculture and Commerce, 1900, pls. 88*).—This is a collection of carefully drawn colored plates of about 150 arborescent species of Japan, showing the flowering and fruiting branches, dissections of flowers and seeds, bark, transverse, radial, and tangential sections and magnified specimens of the wood.

The identification of timber, D. F. MACKENZIE (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 12 (1900), pp. 183–224, figs. 83*).—Illustrated descriptive notes are given upon the timber of 63 species of trees. Photomicrographs of transverse and tangential sections of most of the species are given, and the principal structural and physical characters of each kind of timber are described.

DISEASES OF PLANTS.

A fruit-disease survey of the Hudson Valley in 1899, F. C. STEWART and F. G. BLODGETT (*New York State Sta. Bul. 167, pp. 275–308, pls. 4*).—A report is given on the distribution and amount of damage done by fungus diseases in the Hudson Valley during 1899. The season was an unfavorable one for the development of parasites, and on this account diseases usually very common and destructive did little or no damage. The data presented in this bulletin were secured by circulars of inquiry and personal observations by the authors.

The diseases mentioned are: Apple diseases—scab, leaf spot, twig blight, canker, sooty blotch, russeting of fruit, rust, and sun crack. While all these diseases were observed, the apple crop was in no way injured by any of them. Blackberry diseases—orange rust and leaf spot, the orange rust having been rather destructive. Cherry diseases—fruit spot, leaf spot, black knot, witches' brooms, powdery mildew, and winter injury. Currant diseases—leaf spot and cane blight, both of which were somewhat destructive. The statement is made that the currant-cane blight occurring in the Hudson Valley is not caused by *Nectria cinnabarina* but by a sterile fungus. The exact proof of this fact by inoculation experiments is lacking, but the occurrence in a large number of cases of sterile fungus with the disease is considered sufficient proof. Gooseberry diseases—powdery mildew, root rot, and a dwarfed condition of the foliage which is not ascribed to any particular cause. The root rot has been known for a number of years in one locality and is gradually spreading. It is said to be due to Dematophora. Grape diseases—black rot, downy mildew, root rot, chlorosis, and black knot. The latter disease, while somewhat resembling the black knot of plum and cherry due to

Plowrightia morbosa, was of an entirely different origin. It has been considered in Europe to be due to the action of frost, and has received little attention in this country. Peach diseases—winter injury, leaf curl, yellows, fruit rot, leaf-tip burn, powdery mildew, and scab. Pear diseases—scab, leaf blight, fire blight, body blight or rough bark, and winter injury. The body blight or rough bark is generally considered to be a form of fire blight due to *Bacillus amylovorus*, but according to recent investigations of the station it is now thought to be caused by the apple canker (*Sphaeropsis malorum*), an account of which is given in Bulletin 163 of this station (E. S. R., 12, p. 61). Plum diseases—black knot, fruit rot, leaf blight, and leaf curl. Quince diseases—fruit spot, leaf blight, and fire blight. Raspberry diseases—anthracnose, rust, root galls, winter injury, cane blight, and leaf spot. The cane blight is apparently due to some species of Phoma, but as yet no inoculations have been made. Notes on the leaf blight and sun scald of strawberries complete the bulletin.

A sugar-cane pest in Madras, C. A. BENSON (*Indian Agr., 25 (1900), No. 1, pp. 14–17*).—Notes are given on an investigation begun toward the end of 1897 to determine the cause of a disease of sugar cane. The disease was found not to be of recent origin, and was distributed rather generally throughout the region in which sugar cane was produced. The disease exhibited all the symptoms characteristic of an attack by *Trichosphaeria sacchari*, different stages in its life history being known as root fungus, rind fungus, etc. Canes but slightly affected show no external signs of disease, but transverse sections show one or more bright red spots in some of the internodes, and if these are followed by longitudinal sections they appear as red streaks which branch at the nodes. Where the disease is more advanced, the coloration extends to the ground tissue, so that any section may show red patches. When the disease is still further advanced, the nodes and later other portions become black, the leaves wither, and the entire cane dries up.

The methods adopted in India for growing sugar cane seem to be such as to foster the spread and continued presence of this disease. Some attention was paid to the extent in which different varieties were affected, and it is stated that a comparatively slender cane known as Yerra seems to suffer less than others. It probably owes its partial immunity to the thick rind and to the fact that it does not crack to any great extent.

The author believes that although the disease at present is epidemic in Madras, there is no occasion for alarm, as it has been known there for at least 30 years, sometimes severe and at other times almost disappearing. Attention to cultivation, destruction of litter, and abandoning the growth of cane for a few years, together with giving up the practice of ratooning altogether would probably check the disease.

Gummosis of Prunus japonica, G. MASSEE (*Kew Misc. Bul. 144, pp. 321–326, pl. 1*).—For several years a considerable number of specimens of *Prunus japonica* have been killed or disfigured by parasitic fungi. The disease is first indicated by the appearance of tear-like drops on the branches. These are sometimes solitary and in other instances numerous and more or less crowded. During damp or rainy weather the masses of gum are quite soft and gelatinous. In warm, dry weather the masses shrink and become horny, expanding again when moistened. At first the mass of gum is nearly colorless, but finally becomes black. When the masses are removed, irregular canker-like wounds, which sometimes extend to the pith, are present on the branches, and if such wounds are numerous the branch speedily dies.

The cause of this disease is a species of Cladosporium, morphologically indistinguishable from *C. epiphyllum*. The characteristics of the fungus and its growth are described at some length, and as preventive measures the author recommends spraying with a solution of potassium sulphid. Diseased branches should be removed, and lime thickly strewn on the soil under diseased plants.

Fruit diseases found along the Hudson, F. H. HALL, F. C. STEWART, and F. H. BLODGETT (*New York State Sta. Bul. 167, popular ed., pp. 6*).—This is a popular summary of Bulletin 167 of the station (see p. 154).

ENTOMOLOGY.

The codling moth, J. M. ALDRICH (*Idaho Sta. Bul. 21, pp. 97–112, figs. 6*).—The codling moth has been known in the Clearwater Valley since 1887, and in an untreated orchard near Moscow 21 per cent of the fruit was found to be infested. The length of the pupa stage of this insect in south Idaho is said to be about a week. In the region about Boise and Weiser there are at least 3 broods and a part of a fourth, while in Latah County there are 2 broods and a part of a third. Only a small portion of the late brood seems to survive.

Of 121 apples having the small marks of the third brood, selected in an orchard in Moscow in the month of November, only 20 were found to contain living larvæ.

The author conducted experiments in spraying, during which Paris green was applied in the Bordeaux mixture. The application was made within a week after the blossoms fell. On July 7 an examination was made to determine the effect of spraying. It was found that most of the worms which were destroyed were entering the calyx. On unsprayed trees an average of 16.7 worms entered the side of the apple, while on sprayed trees an average of 14.2 worms entered the apple in the same manner. There was a total saving of 12.3 apples per tree, and of these 9.7 were saved from worms which would have entered the calyx.

while only 2.5 per cent were saved from worms which would have entered the side of the apple. It therefore appears that 15 per cent of the worms entering from the side and 83 per cent of those attempting to enter the calyx were killed. It would seem, therefore, that the spray must be applied while it is still possible for the poison to enter the calyx cup in order to be most effective.

Observations were made upon the variation in the length of time during which the calyx remains open in different varieties of apples. This period varied from 6 to 10 days. The results obtained in Idaho would indicate that later applications of Paris green would be less effective than the first one, since only a small proportion of worms which attempted to enter the sides of apples were destroyed.

The author conducted experiments in banding trees for the purpose of catching the larvæ of the codling moth. Two bands of Canton flannel were placed 8 inches apart on the trunk of each tree. A table is given showing the number of worms caught during the different parts of the season. The highest record for a tree was 494 worms, and the average number of worms caught on 40 trees was about 215.

On one tree 5 bands were placed for the purpose of determining the relative proportion between worms which crawl down the trunk and those which fall to the ground and crawl up the trunk. Worms were caught under all the bands, and the experiment was therefore unsuccessful in keeping the worms separate. The upper band caught about twice as many worms as either of the intermediate ones and almost twice as many as the lower one, indicating that the great majority of worms crawl down the tree.

It would appear from these experiments that the majority of wormy apples which fall have no worms in them at the time, and that possibly the advantage derived from having hogs in the orchard for the purpose of eating windfalls has been overestimated.

The elms and their diseases, H. Garman (*Kentucky Sta. Bul. 84, pp. 51–75, pls. 13*).—The author gives brief notes on the appearance and distribution in the State of the following species of elms: *Ulmus americana*, *U. fulva*, *U. racemosa*, *U. alata*, *U. campestris*, and *U. montana*.

Among the white elms a serious disease has been observed since 1892. The first symptom of the disease is a loss of the leaves at the end of the twigs. As the disease progresses the foliage gradually falls from other parts of the tree until the tree is bare. Small, red, warty pustules, which represent a fungus, are often to be observed on the bark of these trees, but this fungus does not invade the wood of vigorous trees. The twigs are frequently attacked by the buffalo tree hopper, and the inner layer of bark was found to be eaten by a flat-headed grub which resembled the grub of the flat-headed apple-tree borer. In August, 1899, two white elm trees on the college grounds

were dug up and examined. One was dead, the other still alive. Under the bark of the living tree were found the grubs of *Magdalis armicollis*. *Saperda tridentata*, and the adults of *Hylesinus opaculus* were found making burrows preparatory to depositing their eggs.

The author believes, however, that insects are not the first cause of the disease. Attention is called to the fact that the habit of elm roots is to remain in the superficial layers of the soil, oftentimes mingling with the grass roots. From this fact it is apparent that any conditions which tend to impoverish the soil about the trunks of elm trees will gradually bring about a weakened condition of the trees. The trees will then be less able to resist the attacks of various insects and fungi.

The remedies suggested by the author are such as will help to replace the soil elements which are needed by the trees. A mulch of humus composed of dead leaves or other nutrient materials might supply the needed food and protect the soil from rapid evaporation and sudden changes in temperature. If it should be found that the beetles attack living and vigorous trees, it is recommended that the bark be coated with a whitewash containing Paris green or arsenate of lead. Dead and dying elm trees should be cut down and burned, in order to prevent the spread of injurious beetles.

The imported elm-leaf beetle (*Galerucella luteola*) is reported as occurring in large numbers and injuring English elms. American elms were comparatively free from the attacks of this insect. A brief description is given of the beetle in its various stages, together with notes on its habits and life history. For the attacks of this beetle the author recommends spraying with Paris green or arsenate of lead. The application should be made in the early spring as soon as the leaves unfold, and usually 3 sprayings should be sufficient. The larvæ and pupæ which accumulate at the base of the tree may be easily destroyed. Among the natural enemies of this beetle the author mentions the praying mantis and *Podisus spinosus*.

The elm-leaf skeletonizer (*Canarsia ulmiarrosorella*) is reported as injurious to the white elm. Larvæ kept in breeding cages pupated either about the leaves or in the earth. The adults emerge during the latter part of March and in early April. Spraying with Paris green or arsenate of lead is recommended against this insect.

The elm-bark beetle (*Hylesinus opaculus*) was found in all diseased elms. The adults emerged from September 14 until October 15. The form of the burrows of this insect is described. The insect attacks elms only when they are badly diseased.

Insect attacks in 1899, R. S. McDougall (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 12 (1900), pp. 295–307, figs. 5*).—*Cossus ligniperda* is reported as injurious to birches and poplars. A brief description of the insect in its various stages is given. The female

deposits its eggs in clusters in the cracks of the bark at the base of the tree. Isolated trees, or those along the edge of a woodland or an avenue, are most severely attacked. The complete life cycle of this insect extends over about 2 years. Protection against the deposition of the eggs may be afforded by the use of repellant substances painted upon the trunk of the tree.

The author gives notes on the habits, life history, and appearance of a number of species of the genus Chermes. Experiments were conducted on a plantation in Dunbar in the destruction of Chermes. The plantation consisted chiefly of larch, spruce, and pine. It was formed in 1893, and the young trees grew well until 1898, when they became badly infested with Chermes. Pure paraffin applied in a fine spray upon bright, clear days gave the following results: On April 15, 24 infested trees, chiefly larch and Scots pine, were sprayed with pure paraffin. On May 5 it was found that the aphides on the pine had been nearly all killed. The adult Chermes were destroyed, but the eggs were not much affected. On June 15, the eggs on the larch having already hatched, 24 trees were sprayed, and on June 30 it was found that they were effectively cleared of the pests. The young needles of the larch and spruce were slightly scorched by the spray, but during the season they grew fairly well. On June 9, a quarter of an acre of larch and spruce was sprayed with a solution of soft soap in the proportion of 1 lb. to a gallon of water. On June 30 the trees were found to be almost entirely free from insects. Some of the young shoots of the spruce were badly injured, but the larch escaped all damage.

An experiment with paraffin and sour milk dissolved in water gave results too irregular to be detailed. A paraffin emulsion was made of ½ lb. of hard soap, 1 gal. of soft water and 2 gals. of paraffin, and this stock material was then diluted with 8, 10, 12, and 15 times its bulk of water. The strongest solution was found most effective.

Notes are given on the habits and injurious action of *Abraxas grossulariata*. This insect is injurious to the gooseberry, currant, apricot, plum, bramble, and blackthorn. The complete life cycle occupies 1 year. As remedies against this insect, the author recommends pruning the infested twigs and burning the parts removed as well as leaves and other rubbish upon the ground which might afford shelter for the caterpillars. The caterpillars may be destroyed by hellebore and paraffin emulsion. A solution of soft soap and quassia chips is also recommended with the following composition: Soft soap, 6 lbs.; quassia chips, 7 lbs.; and water, 100 gal.

The turnip flea-beetle (*Phyllotreta nemorum*) is described, and notes are given on its injurious habits. In combating this insect, the author recommends that the plants be well fertilized and that the ground be thoroughly cultivated. Cruciferous weeds in the neighborhood of cultivated plants should be destroyed.

Some miscellaneous results of the work of the Division of Entomology (*U. S. Dept. Agr., Division of Entomology Bul. 22, n. ser., pp. 109, figs. 28*).—This bulletin contains the following articles:

The two most abundant Pulvinarias on maple, L. O. Howard (pp. 7–23).—*Pulvinaria innumerabilis* is native to the United States and is found in all parts of the country. Its food plants are the silver-leaf maple, sugar maple, box elder, red mulberry, etc. In the latitude of Washington, D. C., the lice hatch the latter part of May and the early part of July. From young larvæ, which hatch July first, the first adult males issued on August 18. The females take up their winter station upon the twigs early in October. Formation of the egg sac begins about the middle of April. There is one annual generation.

Among the natural enemies of this insect the author mentions the English sparrow, *Chilocorus bivulnerus*, *Hyperaspis signata*, *Dakruma coccidivora*, *Coccophagus lecanii*, *C. flavoscutellum*, *Atropates collinsi*, *Eunotus lividus*, *Aphycus pulvinariæ*, and *Comys fusca*. Severe pruning is recommended soon after the hatching of the larvæ, and also spraying with kerosene soap emulsion or whale-oil soap.

Pulvinaria acericola is a native of the United States and has been reported from Indiana, Iowa, Tennessee, New York, Alabama, New Jersey, and Washington, D. C. Its food plant is *Acer saccharinum*. The eggs hatch in June. The larvæ molt twice, and late in October crawl upon the twigs where they hibernate. Toward the end of May the females migrate to the leaves and extrude their egg sac.

The natural enemies of this insect are *Hyperaspis signata*, *Aphycus hederaceus*, *A. flavus*, *Coccophagus fraternus*, *Pachyneuron altiscuta*, *Chiloneurus albicornis*, and *Leucopis nigricornis*.

The insects to which the name "kissing bug" became applied during the summer of 1899, L. O. Howard (pp. 24–30).—This article is essentially the same as that previously noted (E. S. R., 11, p. 561).

An investigation to determine whether Melanoplus spretus breeds permanently in the Turtle Mountains of North Dakota, W. D. Hunter (pp. 30–37).—This article contains the itinerary of a trip made to investigate this subject. The author states that there are no places upon Turtle Mountains suitable for breeding grounds of this insect. The Rocky Mountain locusts, which have troubled the surrounding country, probably originated in the territory lying northeast of Regina toward the Big Touchwood Mountains. The observed locusts included *Melanoplus spretus*, *M. bivittatus*, and *M. packardi*. At New Rockford, N. Dak., *M. spretus* hatched out in considerable numbers, but gang plows were operated with such effect as to destroy the greater portion of them. The native species which have caused more or less serious losses in this region are *M. atlanis*, *M. bivittatus*, *M. packardi*, and *Dissosteira longipennis*.

The bronze apple-tree weevil, F. H. Chittenden (pp. 37–44).—*Magdalis ænescens* is reported as having attacked apple trees in the State of Washington. The varieties most injured are the Baldwin and Ben Davis; King of Tompkins, Northern Spy, and Bellflower being nearly free from infestation. This insect was found by A. D. Hopkins at Corvallis, Oregon, and has been reported by Jas. Fletcher from British Columbia. Notes are given on the life history and habits of the insect by C. V. Piper, who believes that the attack of this insect is made subsequent to injury caused by the fungus disease known as canker.

Two new Cecidomyians destructive to buds of roses, D. W. Coquillett (pp. 44–48).—These insects, which are described as new species under the names of *Diplosis rosivora* and *Neocerata rhodophaga*, have been reported from Washington, D. C., New York, and New Jersey. The life history of the species is not known to the author. Rose growers have had considerable success in combating these insects with Persian insect powder, buhach, and refuse tobacco stems.

A new violet pest, D. W. Coquillett (pp. 48–51).—This insect is reported as attacking the leaves of sweet violets in Washington, D. C. The species has also been received from New York and Virginia. It is described under the name *Diplosis violicola*. The remedies which have been tried against the insect are hand picking of infested leaves and fumigation with hydrocyanic-acid gas.

Insects and the weather; observations during the season of 1899, F. H. Chittenden (pp. 51–64).—The author made observations on the effect of the cold winter of 1898–99 upon insects. He believes that the unusual severity of the weather was favorable to Northern insects but unfavorable to insects of Southern range. Notes are given on the apparent influence of the weather upon a considerable number of species of insects. The author concludes that the mean winter temperature has more effect in determining the rarity or abundance of insect species than has the mean summer temperature.

Food plants and injury of North American species of Agrilus, F. H. Chittenden (pp. 64–68).—Five species of this genus have been reported as injurious to birch, poplar, chestnut, oak, Lombardy poplar, raspberry, blackberry, and pear trees. *Agrilus anxius* caused considerable damage in parts of Buffalo, and Mr. M. F. Adams reported that the attacks of this insect were made subsequent to injuries produced by *Dryobates pubescens.* The insect has also been reported from Ann Arbor, Mich. One parasite (*Phasgonophora sulcata*) has been reared from this species. *Agrilus otiosus* feeds upon dogwood, butternut, and redbud. *A. bilineatus* is reported as injuring wild chestnut trees in Georgia. A list of 32 species of this genus is given, together with brief notes on their distribution and food plants.

Experiments with hydrocyanic-acid gas as a means of exterminating mealy bugs and other insect pests in greenhouses. H. D. Hemenway (pp. 69–78).—The author conducted a number of experiments with this gas in a wooden box and also greenhouse rooms. The cacti of the greenhouse were infested with *Diaspis cacti.* The room contained cacti, begonias, passifloras, bananas in fruit, etc. The mealy bugs, scales, and aphides were destroyed as well as a large percentage of the sow-bugs and earthworms.

In a house which contained carnations, smilax, violets, chrysanthemums, etc., and was infested with *Dactylopius destructor* and *Orthezia insignis*, 1 oz. of potassium cyanid was used to every 285 cubic feet. The insects were killed, but some of the plants were badly injured. The so-called "dilute method" of fumigation was tried in a camellia room, 1 oz. of potassium cyanid being used to every 3,000 cubic feet. It was fumigated at 6 o'clock p. m. The room was infested with green fly, mealy bug, and Fuller's rose beetle, and the plants in the room included coleus, azaleas, heliotropes, ferns, orange trees, etc. The insects were uninjured except part of the green flies. No damage was done to the plants. A number of other experiments were conducted, and the results are stated in tabular form.

Scale insects on American fruit imported into Germany (pp. 79–83).—An abstract of a paper by L. Reh, previously abstracted (E. S. R., 11, p. 655).

Insect control in Riverside, Cal., F. G. Havens (pp. 83–88).—The orange-growing section of Riverside comprises 12,500 acres of citrus orchards, and this region is one of the 3 divisions of Riverside County. This division is subdivided into 6 districts, and a local inspector has charge of each district. Each orchard is examined tree by tree, and a permanent record is kept by means of cross-lined paper. Besides inspection, the work of the insect-pest control includes eradication and quarantine. Very efficient methods of eradication have been devised and put into practice at Riverside. In 1898, 1,609 trees on 345 acres were infested with red scale. In 1899 the same orchards contained only 433 infested trees. The quarantine work has been so efficient that no insect pests have been introduced and become established since the existence of the horticultural commission.

Notes on a brief trip to Porto Rico in January and February of 1899, A. Busck (pp. 88–93).—A brief account of a trip to Porto Rico for the purpose of investigating the insect conditions of that colony. Notes are given on insects injurious to sugar cane, coffee, and tobacco. *Gryllotalpa hexadactyla* is reported as being exceedingly injurious to young tobacco plants. Large colonies of bees were frequently met with in hollow trees, and a considerable honey product is obtained from them. The article contains a list of the Coccidæ collected by the author and identified by T. Pergande and T. D. A. Cockerell.

Under the caption "General Notes" are given observations of an economic character upon a considerable number of injurious and other insects, as well as many notes from the various correspondents of the Division in different parts of the country.

The choice of colors by insects, F. PLATEAU (*Mem. Soc. Zool. France, 12 (1899), No. 4, pp. 336–370*).—A critical review is given of the literature of the subject. In investigating the question whether insects are guided in their choice of flowers by colors, the author made observations upon a considerable variety of insects, including, among others, species of Megachile, *Bombus terrestris*, *B. muscorum*, the honeybee, *Eristalis tenax*, *Papilio machaon*, etc.

To this question he makes a negative reply. It is admitted that insects may recognize at a distance the presence of flowers, but it is uncertain whether this recognition is due to the contrast between an area of flowers and their surroundings or to the odor of the flowers, or both. As soon as insects arrive among a group of flowers they seem to exercise no choice in the matter of color, but visit indifferently blue, red, yellow, white, or green flowers. If in a given species of plants the different floral variations in color exist in equal quantities, insects pass from flowers of one color to those of another without any discrimination. Occasionally the insects seem to prefer plants of one color for a short time and then pay more visits to flowers of another color. If in a group of flowers of a given species the floral variations in color are represented in unequal quantities, the number of insect visits to flowers of the different colors will be proportional to the number of flowers of these various colors.

Spraying notes, L. H. BAILEY ET AL. (*New York Cornell Sta. Bul. 177, pp. 235–253*).—Experiments were conducted in fighting San José scale on apple, pear, plum, almond, and willow trees. A 20 per cent mechanical mixture of kerosene and water was sprayed upon one lot of trees on April 10 and 11. Another lot of trees was sprayed on June 6, and all the trees were sprayed a second time on June 24, 3 especially dense trees receiving a third application on June 29. The young scale insects were abundant on young unsprayed currants by June 23. On examining the sprayed trees on December 11, few live scales could be found. On the smooth-barked willows all the scales were killed.

The authors believe that while fumigation may be a more thorough method than spraying, the San José scale may be held in check by spraying with kerosene. Fumigation will perhaps be found more desirable in nursery rows, but for use on growing trees spraying is belived to be "cheaper, simpler, and perhaps equally effective."

Some experiments were conducted with Paris green, Paragrene, Green Arsenite, XX, Pink Arsenoid, Green Arsenoid, Green Arsenoid

No. 53, and arsenite of lime. These insecticides were used in four different strengths, $\frac{1}{4}$ lb., $\frac{1}{2}$ lb., 1 lb., and $1\frac{1}{2}$ lbs. per barrel of 48 gals. Orchard application of these substances was made on June 10, while potatoes were sprayed on July 10 and 17.

Tables are presented showing the comparative effects of the 4 different strengths of the different insecticides upon foliage. A test was made of the insecticide value of these materials on potatoes. Two strengths of the substances were used, $\frac{1}{4}$ lb. and $\frac{1}{2}$ lb. to a barrel of 48 gals. Both strengths of Paris green, Paragrene, XX, and Green Arsenoid killed all the potato beetles, and nearly all the beetles were killed by both strengths of Pink Arsenoid, Green Arsenoid No. 53, and Green Arsenite.

Brief notes are given on the composition of various arsenical poisons. The authors find that no damage is done to foliage in spraying with $\frac{1}{4}$ lb. of the ordinary arsenites to the barrel, provided less than $3\frac{1}{2}$ per cent of soluble arsenic is present in the insecticide.

Attention is called to the importance of the specific gravity of various arsenical poisons in spraying. Considering the specific gravity of Paris green to be 10, other insecticides compare in weight as follows: Green Arsenite 10, Pink Arsenoid 9, Paragrene 7, Green Arsenoid 7, XX 4, Green Arsenoid No. 53, 4. Equal amounts of these arsenites shaken in water follow nearly the same order in settling, Paris green being first, and Green Arsenoid No. 53 last. Paragrene, Green Arsenite, Green Arsenoid, and arsenite of lime are all recommended as arsenical sprays. The comparatively high percentage of soluble arsenic in Green Arsenoid No. 53 makes this substance objectionable.

Experiments were conducted to determine the effect of copper carbonate and potassium sulphid on the foliage of Japanese plums, copper carbonate being used at the usual strength and potassium sulphid at the rate of 1 oz. to a gallon of water. Both substances were rather more injurious to the foliage than Bordeaux mixture. Where these substances were used too freely, the shot-hole effect upon the foliage was very noticeable.

The general conclusions of the authors may be stated as follows: The mechanical mixture of kerosene and water will probably displace kerosene and soap emulsion. In spraying with kerosene and water, early spring or late fall seem to be the preferable seasons. Paragrene, Green Arsenite, Green Arsenoid, and arsenite of lime are equal if not superior to Paris green. Unless lime is added, the simple solution of copper sulphate, 4 oz. to the barrel, can not be used without injury to the foliage.

The nature and use of certain insecticides, J. L. PHILLIPS and H. L. PRICE (*Virginia Sta. Bul. 97, pp. 7-26*).—The authors describe and give brief notes on the common arsenical, contact, and tracheal insecticides and on the methods of their application. Experiments

were tried upon 25 plats of potatoes with various arsenical poisons in aqueous solution, for the purpose of determining the effectiveness of these insecticides in killing the potato beetle, and also their effect upon the foliage of the potato. The results of these tests may be tabulated as follows:

Effect of insecticides on potato beetle and foliage.

Insecticide.	Amount per 100 gal. of water.	Effect on beetles.	Effect on foliage.
London purple	1 lb	Killed nearly all the beetles	No damage.
Paris green	1 lb	do	Do.
Paragrene	2 lbs	do	Do.
Do	1 lb	do	Do.
Do	½ lb	Some beetles escaped	Do.
Special laurel green	6 lbs	Killed all the larvæ	Foliage badly damaged.
Do	4 lbs	do	No damage.
Do	1 lb	Some beetles escaped	Do.
Green Arsenoid	2 lbs	Killed all the beetles	Do.
Do	1 lb	Killed nearly all the beetles	Do.
Do	½ lb	A few beetles escaped	Do.
White Arsenoid	2 lbs	Killed nearly all the beetles	Slight damage.
Do	1 lb	Many beetles escaped	No damage.
Do	½ lb	A large proportion of the beetles escaped.	Do.
Pink Arsenoid	2 lbs	Killed all the larvæ	Slight damage.
Do	1 lb	do	No damage.
Do	½ lb	Several larvæ escaped	Do.
White Arsenate	2 lbs	Killed only a few beetles	Do.
Do	1 lb	do	Do.
Swift's Arsenate of Lead	8 lbs	Killed all the larvæ	Do.
Do	4 lbs	do	Do.
Do	2 lbs	Small proportion of beetles escaped.	Do.
Parine green	2 lbs	Killed all larvæ	Do.
Do	1 lb	do	Do.
Do	½ lb	Small proportion of larvæ escaped.	Do.

Experiments were tried in spraying fruit trees with pure kerosene and with the kerosene-water mixture. The results which were obtained indicate that "pure kerosene can be used on all our fruit trees in the dormant season and with proper precaution during the growing season also, except on peach. Water mixtures have with us proved as dangerous as pure kerosene. This substance should be used on trees only in cases of necessity."

The pea louse (*Nectarophora destructor*) is reported as having caused considerable damage in various parts of the State. A number of experiments were conducted with different insecticides in combating this insect. The insecticides which were used were Good's No. 6 tobacco-potash soap and a kerosene-water mixture. From these experiments it was found that soap solutions in the proportion of 1 lb. to 6 or 8 gal. of water, although very effective in killing the lice, caused injury to the foliage. Soap solutions at the rate of 1 lb. to 10 or 12 gal. of water were not so destructive to the lice but caused no injury to the plants. In their experiments the authors found that considerable damage was done to the foliage by the kerosene-water mixture, and this substance is, therefore, not recommended for spraying peas.

The queen bee, A. GALE (*Agr. Gaz. New South Wales, 11 (1900), No. 3, pp. 204-206, figs. 6*).—The author gives descriptions of the method of formation and appearance of queen cells, and illustrations are given of these cells as built under different conditions.

Sericulture in Austria during the last 50 years, G. BOLLE (*Atti e Mem. Ital. R. Soc. Agr. Gorizia, 40 (1900), No. 1-2, pp. 29-39, figs. 7*).

Beetles injurious to fruit-producing plants, O. LUGGER (*Minnesota Sta. Bul. 66, pp. 83-332, figs. 249*).—This bulletin contains a brief classification of the various families of beetles and a general account of a large number of species which are known to be injurious to fruit trees and small fruits. In most cases the approved remedies are suggested for treatment of these insects.

Insect damage to spruce timber in Maine and New Hampshire, A. CAREY (*Forester, 6 (1900), No. 3, pp. 52-54*).—In northern Vermont and New Hampshire outbreaks of forest insects occurred about 30 years ago, and also about 15 years ago. During investigations which were carried on to determine the cause of the unusual death of spruce timber at the present time, it was found that the damage was due to the attacks of *Dendroctonus polygraphus* var. *rufipennis*.

Wood-boring caterpillars, H. FAES (*Chron. Agr. Canton Vaud, 13 (1900), No. 5, pp. 104-110, figs. 2*).—Notes on the habits and life history of *Cossus ligniperda*, *Zeuzera æsculi*, and *Trochilium apiforme*.

Some insect notes, F. M. WEBSTER (*Ent. News, 11 (1900), No. 4, pp. 436-439*).—Notes on *Halticus uhleri*, *Crioceris 12-punctata*, *Oberea bimaculata*, and *Cecidomyia destructor*.

The forest tent caterpillar, E. P. FELT (*Country Gent., 65 (1900), No. 2459, p. 217*).—Brief notes on the effect of the depredations of these insects upon the quality of maple sugar.

The occurrence of a plant louse on the roots of sugar beets, P. DOERSTLING (*Ztschr. Pflanzenkrank., 10 (1900), No. 1, pp. 21, 22*).—The author reports that a species of aphis appeared in large numbers on the roots of sugar beets during the autumn of 1899. The plant lice were also observed on the under side of the leaves. The damage to sugar beets is estimated at from 30 to 40 per cent in different fields. The species of plant lice was not identified.

Aspidiotus diffinis, C. L. MARLATT (*Ent. News, 11 (1900), No. 4, pp. 425-427*).—This scale insect was probably introduced from Europe. It has been reported as infesting basswood in Canada, and it appears that *A. jatrophæ* is a synonym of this species. The insect is found in large numbers on basswoods in Ontario and may perhaps become a species of considerable economic importance. A brief bibliography is added to the article.

A new genus of Atropidæ, N. BANKS (*Ent. News, 11 (1900), No. 4, pp. 431, 432*).—*Psocinella slossonæ* is described as a new genus and species of this family. The species is reported as attacking butterflies in a collection and may prove to be a museum pest.

Cytodites nudus in the common fowl, E. V. WILCOX (*Centbl. Bakt. u. Par., 2. Abt., 6 (1900), No. 5, pp. 147-153, fig. 9*).—A brief discussion of the literature concerning this mite, together with notes on its occurrence in Montana.

The species of the orthopteran genus Derotmena, S. H. SCUDDER (*Proc. Amer. Acad. Arts and Sci., 35 (1900), No. 19, pp. 385-395*).—A monographic account of this genus.

Metzneria lappella, T. W. FYLES (*Canad. Ent., 32 (1900), No. 1, pp. 15, 16*).—This European species is reported as feeding on the heads of burdock.

Phylloxera and the diseases of the vine, V. THIÉBAUT (*Prog. Agr. et Vit., 17 (1900), No. 12, pp. 365-367*).

Phylloxera in Switzerland, B. H. RIDGELY (*U. S. Consular Rpts., 62 (1900), No. 234, pp. 298, 299*).—Attention is called to the seriousness of the phylloxera problem

in the Canton of Vaud and a brief report is given of the action of the Canton Council of State at Lausanne in recommending the extensive use of American vines.

A new remedy for phylloxera, J. DUFOUR (*Chron. Agr. Canton Vaud, 13 (1900), No. 2, pp. 29–34*).—Soot has recently been proposed as a new remedy for this insect. The author calls attention to the fact that many previous experiments have been made with this substance without success.

Phytoptus vitis (*Agr. Jour. Cape Good Hope, 16 (1900), No. 2, p. 103*).—It is recommended that in infested vineyards all dry leaves and rough bark be burned at the end of the season.

A peculiar organ which occurs in Poecilocerus socotranus, H. A. KRAUSS (*Zool. Anz., 23 (1900), No. 610, pp. 155–167, fig. 4.*)—The author has discovered an organ in the pronotum of this grasshopper which seems to have a phosphorescent function, or at least to be analogous to phosphorescent organs of other insects.

The gypsy moth (Porthetria dispar), S. LAMPA (*Ent. Tidskr., 21 (1900), No. 1, pp. 34–46, pl. 1*).—Descriptions are given of the eggs, larvæ, pupæ, and adult males and females of this species, together with notes on its habits and life history. Brief reference is made to the work which was carried out in the southeastern part of Sweden in fighting the gypsy moth. The government appropriated $2,800 for this purpose. A brief note is also given on the natural enemies of the gypsy moth.

On the molt of pupæ in Pterophorus, T. A. CHAPMAN (*Entomologist, 33 (1900), No. 442, pp. 82–85*).—The author made observations especially on the pupation of *P. galactodactylus*. The species pupates beneath a leaf. The molt took place in 3 observed examples about 1 o'clock p. m., after 2 days of quiescence. The larvæ holds on to the leaf by the anal prolegs only. Molting takes place rapidly and is accomplished in about 15 minutes.

Depredations of the cottony maple scale, C. E. BROWN (*Bul. Wisconsin Nat. Hist. Soc., n. ser., 1 (1900), No. 1, pp. 65–67*).—*Pulvinaria innumerabilis* occurred in unusual numbers in Wisconsin notwithstanding the severity of the previous winter. In Milwaukee the trees were subsequently attacked by the tussock moth.

The pear and cherry tree slug, A. M. LEA (*Agr. Gaz. Tasmania, 7 (1900), No. 8, p. 176*).—Brief notes on the habits, life history, and means of combating *Selandria cerasi*.

The deposition of the eggs of Tortrix ambiguella, J. PERRAUD (*Prog. Agr. et Vit. (Éd. L'Est), 21 (1900), No. 3, pp. 80–83*).—The female lays about 4 or 5 eggs on each grape.

The action of environment on the development of Tortrix ambiguella, J. PERRAUD (*Prog. Agr. et Vit., 17 (1900), No. 13, pp. 391–393*).—The author discusses the influence of climatic and other conditions upon the observed alternation of periods of relative abundance and scarcity of this insect. With the present knowledge of the problem, it seems to be impossible to indicate accurately the determining factors of the variation in numbers.

The spiny elm caterpillar, C. M. WEED (*New Hampshire Sta. Bul. 67, pp. 123–141, figs. 13*).—A popular account of the habits, life history, and natural enemies of *Vanessa antiopa*, with brief notes on remedies to be applied against this insect. The species is said to have been unusually abundant on elm trees during the past 3 years in New Hampshire. It is believed to be single-brooded in the State.

Spraying tall trees, P. MACMAHON (*Queensland Agr. Jour., 6 (1900), No. 2, pp. 118, 119, pl. 1*).—The author gives brief notes on kerosene emulsion, resin wash, London purple, Bordeaux mixture, and Eau celeste. Experiments were made in spraying tall trees which were infested with *Ceroplastes rubra*. An upright post was securely fixed in the spray wagon, and to this post a long bamboo rod which supported the hose was so attached that it could be readily directed toward the desired part of the tree.

The application of Sanatol, E. KRÜGER (*Ztschr. Vet., 12 (1900), No. 3, pp. 124, 125*).—Sanatol has been recommended for gross disinfection and as a deodorizer and repellant of flies. Experiments were conducted in which stalls were sprayed with a 1 per cent aqueous solution of Sanatol. This application had a striking effect in repelling the flies from the stable.

Carbon bisulphid, E. PERRONCITO (*Gior. R. Soc. Accad. Vet. Ital., 49 (1900), No. 4, pp. 75–79*).—The author calls attention to the great value of this substance in fighting phylloxera and states that its antiseptic power is not very great. Spores of the anthrax bacillus survived an exposure to this substance of 49 days' duration.

Treatment with bisulphid of carbon, J. DUFOUR (*Chron. Agr. Canton Vaud, 13 (1900), No. 5, pp. 89–101, figs. 2*).—A general account of the nature and action of carbon bisulphid, together with detailed directions for its use in combating phylloxera.

The use of arsenical salts as insecticides, H. GROSJEAN (*Prog. Agr. et Vit., 17 (1900), No. 14, pp. 410–414*).

Inspection of Paris green, W. C. STUBBS and W. T. JONES (*Louisiana Stas. Bul. 58, pp. 265–276*).—This includes the text of the State law providing for the inspection of Paris green, and a brief report on the operation of the law, with analyses of 38 samples of Paris green.

The entomologists' directory, H. SKINNER (*Philadelphia: American Entomological Society, 1900, pp. 84*).—This directory contains the names, addresses, and special departments of study of the entomologists in the United States and Canada, together with a geographical arrangement of the names, a list of entomological societies, their secretaries, and the official entomologists of the agricultural colleges and experiment stations.

FOODS—ANIMAL PRODUCTION.

Dietary studies of university boat crews, W. O. ATWATER and A. P. BRYANT (*U. S. Dept. Agr., Office of Experiment Stations Bul. 75, pp. 72*).—With a view to studying the effects of muscular work on food consumption, dietary studies were made with the Harvard University and Freshman boat crews when training at Cambridge and before the races at Gales Ferry; with the Yale University crew at New Haven and Gales Ferry, and with the captain of the Harvard Freshman crew at Gales Ferry. The results of the studies are summarized in the following table:

Summary of results of dietary studies of university boat crews.

[Nutrients in food actually eaten per man per day.]

	Protein.	Fat.	Carbohydrates.	Fuel value.
	Grams.	*Grams.*	*Grams.*	*Calories.*
Harvard University crew at Cambridge	162	175	449	4,130
Harvard Freshman crew at Cambridge	153	223	468	4,620
Yale University crew at New Haven	145	170	375	3,705
Harvard University crew at Gales Ferry	160	170	418	4,075
Harvard Freshman crew at Gales Ferry	135	152	416	3,675
Yale University crew at Gales Ferry	171	171	434	4,070
Captain of Harvard Freshman crew	155	181	487	4,315
Average	155	177	440	4,085

The results are discussed and compared with the results of dietary studies with athletes, college clubs, mechanics, farmers, and professional men, and with the commonly accepted dietary standards.

Milk protein as a food, BACKHAUS and R. BRAUN (*Ber. Landw. Inst. Univ. Königsberg, 5 (1898–99), pp. 34–60*).—A number of feeding experiments with dogs and rabbits and digestion and metabolism experiments with rabbits on the value of the casein of skim milk are reported. Casein was precipitated in different ways. The authors' principal conclusions were in effect as follows: Protein is supplied more cheaply by milk than by almost any animal or vegetable food material. The feeding experiments reported show that milk protein is almost completely digested, and that it is capable of supplying the protein requirements of animals for long periods. The insoluble casein possessed the same nutritive value for this purpose as the soluble casein salts. Nevertheless, the preparation of such soluble salts is of importance, since they may be conveniently used for many purposes. Judging by the experiments carried on a simple method, which at the same time gives good results, consists in precipitating the milk protein with hydrochloric acid, having previously warmed the milk, carefully washing the precipitate, and drying it at a low temperature, and mixing the finely ground powder with salts, which render it soluble. For this latter purpose sodium citrate is especially valuable, since it has no taste, while sodium phosphate is valuable from a physiological standpoint on account of the phosphorus with which it supplies the body. Sodium borate is valuable on account of its antiseptic properties. A mixture of these salts is regarded as preferable to either alone.

Commercial feeding stuffs in New York, W. H. JORDAN and C. G. JENTER (*New York State Sta. Bul. 166, pp. 233–273*).—The New York law regarding the sale and analysis of commercial feeding stuffs is quoted, the value of such feeding stuffs discussed, a classification suggested, and a report made of a large number of analyses of samples collected in 1898 and 1899, including the following:

Cotton-seed meal, cotton-seed feed, linseed meal (old and new process), gluten meal ('M' and Chicago), gluten feeds (Buffalo, Climax, Davenport, Diamond, Joliet, 'R,' Peoria, Empire, Waukegan, Davenport corn feed, and 2 gluten feeds without special name), malt sprouts, brewers' grains from lager beer and from ale, distillery waste, buckwheat middlings, buckwheat feed, buckwheat ships, wheat bran, ship stuff, wheat feeds (Royal, Buckeye, King Winter Wheat, New England mixed, and middlings from different grades of flour and wheat), hominy feed, hominy meal, hudnuts, H-O standard dairy food, H-O standard horse food, H-O feed, Quaker oats, Victor feed, Victor corn and oats, corn and oat feed, chop feed, H-O defi feed, X oat feed, Schumaker's stock food, corn, oat, and barley feed, wheat feed, pea meal, malt skimmings, rye feed, scorched wheat' sugar-corn feed, starch feed (wet and air dry), gluten feed (wet and air dry), and Clover meal.

The carbohydrates of mixed feeds and other feeding stuffs are discussed, special attention being called to the superiority of the dry

matter of cereal grains over that of coarse fodders. The carbohydrates in a number of different feeding stuffs is reported:

Carbohydrates in dry matter of several feeding stuffs.

	Sugars and starch.	Total nitrogen-free extract.	Sugars and starch in nitrogen-free extract.	Digestibility of the nitrogen-free extract.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Cotton-seed meal	16	27.9	57.4	50
Linseed meal (old process)	13.2	39.2	33.7	78
Linseed meal (new process)	20.8	40.8	51	84
Gluten meal	38.2	49.8	76.7	93
Buffalo gluten feed	27.3	58.3	46.8	84
Davenport gluten feed	29.8	60.9	48.9	....
Diamond gluten feed	31.6	61.6	51.3	....
Joliet gluten feed	34	66	51.5	....
Peoria gluten feed	28.9	59.8	48.3	90
Malt sprouts	23.1	49.6	46.6	69
Buckwheat middlings	27.3	48.3	56.5	....
Wheat bran	23.6	60.5	39	69
Wheat middlings	38.8	64.2	60.4	85
Hominy feeds	50.1	72.7	68.9	....
H-O dairy feed	34.6	60.4	57.3	....
Oat feed	29.4	61.5	47.8	60
Victor feed	43	70.3	61.2	....
Chop feeds	47.5	73.5	64.6	....
X oat feed	16.1	57.9	27.8	....

"Many of the materials mentioned above when compared with the grains from which they are derived show a depletion of sugars and starch and a corresponding relative increase in the nitrogen-free extract of the less valuable compounds. This is especially true of the wheat offals, the gluten feeds, and the oat feed mixtures. In the case of the one sample of gluten meal examined the starch still constituted a large proportion of the nitrogen-free extract. The chop feeds and other similar combinations contain as a rule quite a proportion of corn, that furnishes nearly all the starch which is found in these mixtures. . . .

"These facts are in harmony with the outcome of digestion experiments, from which we learn that the nitrogen-free extract of the whole grains is much more digestible than that of most of the manufacturing wastes which come from them. . . .

"Some 'mixed feeds' apparently are compounded and advertised on the assumption that feeding stuffs are to be compared in value solely on the basis of their percentage of protein and fat. This is a false basis. The quality of the accompanying carbohydrates must always be considered. For instance, it would not be difficult to simulate the composition of corn meal or of wheat middlings by mixing oat hulls with some of the old-style linseed meal, adding a little crushed linseed to make up the deficiency of fat. But would the mixture equal corn meal in value? By no means. In one case the protein and fat would be associated with woody fiber in large proportion, and in the other case with little else than starch. The net value of the corn meal would be much above that of the mixture as measured by the extent and labor of digestion."

The various oat feeds, proprietary, and other mixed feeds are discussed at some length and appear, in the authors' opinion, to contain an undue proportion of crude fiber, the proportion of oat hulls being larger than the oat kernels present.

"Some of them must contain not less than 50 lbs. of oat hulls per 100 lbs. . . .

"In certain brands an amount of some highly nitrogenous feeding stuff like cottonseed meal or gluten meal is found, the object of its use being to bring up the protein content to the standard of wheat bran. This certainly improves the feed, but at the

same time the presence of high-quality ingredients adds nothing to the value of the inferior constituents. Grinding corn with oat hulls, for instance, may not injure the corn, but it does not improve the hulls. They are still hulls and retain all their characteristics as a feeding stuff."

In order to study the effect of introducing oat feeds into grain rations, a digestion experiment was made with sheep, one of the commercial oat feeds sold in New York being used. The average coefficients of digestibility obtained were as follows: Dry matter 58, organic matter 59.5, protein 82.5, fat 92, nitrogen-free extract 60.5, and crude fiber 33 per cent.

This result was compared with the average coefficients of digestibility of whole oats and maize, the comparison showing in the authors' opinion that whole oats furnished about 12 per cent and maize 31 per cent more total nutritive material than the oat feed. Besides the material including the entire grain is of better quality, being made up more usually of protein and the easily digested carbohydrates.

The authors also report the analysis of a number of condimental feeding stuffs.

"In these mixtures were found, as the principal constituent, some common feeding stuff like bran or other wheat offals, corn offals, linseed meal, and so on. The special ingredients added ostensibly for medicinal effect, were found to include charcoal, fenugreek, gentian, sulphur, salt, saltpeter, sodium sulphate, iron compounds, and pepper.

"Particular attention is called to the prices at which these 'foods' are sold. The range is from $100 to $500 per ton, which is at least from $70 to $470 per ton more than the materials are worth for food purposes. It may be claimed, as some of the manufacturers urge, that these mixtures should be regarded as medicines. Even if this is true the farmer who wishes to administer any of these common substances to his animals can do so at a small fraction of their cost in condimental foods by purchasing them as drugs and then mixing them with the grain ration as he wishes. For the promoters of these mixtures to claim that they have any knowledge of compounds and compounding not common to veterinary medicine is charlatanism in its most offensive form."

On the influence which the kind and amount of food exercises upon the amount of metabolism and the power to perform work, E. PFLÜGER (*Arch. Physiol.* [*Pflüger*], *77* (*1899*), *No. 9–10, pp. 425–482*).—The author reports a number of experiments with cats and dogs. In some cases the balance of income and outgo of nitrogen was determined, as well as the respiratory quotient. Experiments were made under different conditions of feeding and fasting.

The experiments are discussed in relation to the early work of Bidder and Schmidt,[1] and the theories of nutrition and the production of energy promulgated by Voit and his followers. The author's principal deductions follow:

The addition of protein to a maintenance ration caused an increase in metabolism and the productive power. Further, it caused an increase

[1] Abstracted in U. S. Dept. Agr., Office of Experiment Stations Bul. 45.

in the body weight due to an increase in cell substances. This increase of cell substance under favorable conditions can be induced until the body weight is doubled. Metabolism and productive power of the body increased in direct proportion to the increase in body weight induced by protein. The highest metabolism and the greatest productive power can therefore be induced only by the most abundant supply of nitrogen in the food. Each diminution of the daily supply of protein caused a decrease in the metabolism and productive power, even if the protein omitted was replaced by an amount of fat and carbohydrates calculated to supply the same amount of energy. An increase in the amount of fat or carbohydrates in the diet did not cause an increase in metabolism or in the power of the body considered as a machine. Protein added to the diet replaces in the metabolism of the body a quantity of fat possessing the same force value, provided, of course, that the diet to which the protein is added contains fat, etc., as well as protein. The laws of the metabolism of protein are the same in dogs and cats. No formation of fat from protein in the animal body, as insisted upon by Voit and Cramer, was observed. Man can not be nourished by protein alone, since it would be impossible to digest the amount which would be required. According to the investigations of the author and his pupils, a young man instinctively uses an amount of protein which is sufficient for about one-fifth of the total productive power of the body. Man can digest much more protein, but it seems necessary to assume that for omnivora the protein consumed should not exceed a certain limit. This is not proven, but man instinctively refrains from an exclusive meat diet.

Concerning direct and indirect calorimetric measurements with animals in a study of nitrogen equilibrium when fasting and fed after fasting, P. P. Avrorov (*Russ. Arch. Patol. Klin. i Bakt., 7 (1899), p. 430; abs. in Physiologiste Russe, 1 (1899), No. 15–20, pp. 304–306*).—A number of experiments with dogs are reported. Some of the principal conclusions follow. The metabolism of matter and the production of heat takes place in animals with remarkable regularity and uniformity when the experimental conditions are as uniform as possible. The intensity of the metabolism of matter and the production of heat in dogs is inversely proportional to the size of the animal and directly proportional to the surface area. On an average during the period of fasting the cleavage of fat was greatly diminished, while the cleavage of proteids was reduced to a minimum. The heat produced was diminished 15 or 16 per cent and the production of carbon dioxid was diminished from 21 to 22 per cent. Gains in protein were made after fasting with little or no effect upon the production of heat. The albumin of the living tissues of the body did not differ as regards its potential energy from the albumin of the meat fed. The production of heat was found to be closely connected with the excretion

of carbon dioxid. As shown by comparison, the results obtained directly with the calorimeter and those obtained indirectly by calculation from the data of metabolism experiments agreed very closely. Other conclusions are drawn which have to do with feeding after fasting.

Steer feeding, R. H. McDowell (*Nevada Sta. Bul. 41, pp. 6, pls. 6*).—With a view to learning the amount of alfalfa hay required for a pound of gain, 4 steers were fed from December 11, 1897, to May 9, 1898. From the beginning of the test to March 2 they were given alfalfa hay only, and from that date until May 9 cracked corn was fed in addition to the hay. The steers had been on pasture without grain previous to the test. During the test they were fed in box stalls. The average results for the 2 periods follow:

Results of feeding steers alfalfa hay with and without grain.

	Weight at beginning of test.	Period No. 1.		Period No. 2.		
		Gain in weight.	Alfalfa hay eaten per pound of gain.	Alfalfa hay eaten.	Cracked corn eaten.	Gain in weight.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Steer No. 1	1,350	95.0	21.7	1,928.25	27.2	120.0
Steer No. 2	1,160	102.5	23.2	1,975.40	140.0	137.5
Steer No. 3	1,230	112.5	20.3	1,229.90	13.3	37.5
Steer No. 4	1,090	145.0	15.1	2,006.00	20.3	74.0

Two days after the close of the test steers Nos. 3 and 4 were slaughtered, the dressed weight being 56.6 and 56.49 per cent, respectively, of the live weight. Steer No. 1 was fed until December 2, gaining in this time 247.5 lbs. and consuming 6,262.25 lbs. of alfalfa hay, 174.5 lbs. of cracked corn, and 655.3 lbs. of bran. The dressed weight was then found to be 61.7 per cent of the live weight. The feeding was continued with steer No. 2 until May 7. In this time there was a gain of 50 lbs., 473.9 lbs. of hay and 104.5 lbs. of cracked corn being consumed. The dressed weight of this steer was found to be 55.9 per cent of the live weight.

Sheep-feeding experiments at Leswalt, A. P. Aitken (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 12 (1900), pp. 23–46*).—Continuing previous work, the author reports a test, conducted at Leswalt, of the value of turnips alone and supplemented by different concentrated feeds for sheep. The test, which was made with 6 lots of 20 sheep each, began November 19, 1898, and covered 19 weeks. It was divided into 2 periods of 9 and 10 weeks, respectively. All the lots were fed turnips. In addition, lot 2 was fed maize, lot 3 oats, lot 4 equal parts of oats, dried distillery grains, and linseed cake, lot 5 dried distillery grains, and lot 6 linseed cake. During the first half of the test half a pound per head daily of the concentrated feeding stuffs was fed. During the latter half of the test the oats and maize

were increased to about ¾ lb. and the other feeds in proportion to their cost. At the close of the test the sheep were slaughtered and judged by an expert. The average results for the whole test follow:

Turnips with and without concentrated feeds for sheep.

	Weight of lot at beginning of test.	Average gain per head per week.	Average weight of carcass.	Average weight of tallow.	Average weight of skins.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Lot 1 (fed turnips)	1,387	1.31	48.9	4.5	13.1
Lot 2 (fed turnips and maize)	1,397	1.80	58.3	5.6	14.7
Lot 3 (fed turnips and oats)	1,423	1.35	53.2	5.6	14.1
Lot 4 (fed turnips, oats, dried distillery grains, and linseed cake, 1 : 1 : 1)	1,405	2.01	58.4	5.3	15.0
Lot 5 (fed turnips and dried distillery grains)	1,438	2.33	62.8	6.7	16.6
Lot 6 (fed turnips and linseed cake)	1,377	1.78	58.4	5.0	15.0

According to the author, the most satisfactory gains were made by lots 5, 4, and 6, in the order named. Lot 3 ranked fifth, the results not being very different from those obtained with lot 1, which received no concentrated feeding stuff. In the opinion of the expert who judged the carcasses, lot 2 was the most satisfactory and lot 6 next.

Pig feeding, R. H. McDowell (*Nevada Sta. Bul. 40, pp. 16*).—The value of alfalfa hay when fed alone and when fed with turnips and with roots, corn, and peas was tested with 4 grade Poland-China pigs divided into 2 lots of 2 each.

From December 12 to January 2 both lots were fed alfalfa hay only, consuming a little over 99.1 lbs. per lot. Lot 1 weighed 262.5 lbs. at the beginning of the test and lot 2, 297.5 lbs. Lot 1 lost 32.25 lbs. and lot 2, 51 lbs.

From January 2 to January 23 both lots were fed turnips and alfalfa hay, consuming 266 lbs. of turnips per lot in addition to some 90 lbs. of alfalfa hay. During this time lot 1 gained 15.25 lbs. and lot 2, 13.75 lbs. From January 23 to March 6 lot 1 was given 121.1 lbs. of peas in addition to 86.4 lbs. of alfalfa hay and 863.5 lbs. of turnips and lot 2 121.1 lbs. of corn in addition to 90.9 lbs. of alfalfa hay and 866 lbs. of turnips. The gains of the 2 lots were 94.75 and 82.75 lbs., respectively.

From March 6 to March 16 lot 1 consumed 5.8 lbs. of hay, 19 lbs. of sugar beets, and 102 lbs. of peas and gained 19.75 lbs. From March 6 to March 22 lot 2 consumed 5.9 lbs. of alfalfa hay, 163 lbs. of sugar beets, and 187 lbs. of corn, gaining 62.5 lbs.

An appendix to the bulletin contains answers received from farmers to a number of questions regarding the feeding of alfalfa to pigs.

Experiments in feeding pigs for the production of pork, H. J. Patterson (*Maryland Sta. Bul. 63, pp. 41, pls. 10, dgms. 2*).—Statistics of the pig-raising industry in Maryland are given, and 12 tests with pigs are reported in which different feeding stuffs were compared.

Two lots of pigs about 8 weeks old were fed for 165 days to compare separator skim milk with a quantity of green clover furnishing approximately the same amount of protein. Both lots had a basal ration of corn and cowpea meal, linseed and gluten meal, 8:1:1. The average daily gain per pig in the lot fed skim milk was 1.26 lbs., and in the lot on clover, 0.6 lb., the cost of a pound of gain in the 2 cases being 4.09 and 3.7 cts., respectively. The pigs were slaughtered at the close of the test, the heaviest weighing over 200 lbs. dressed. On the basis of his results the author calculates that green clover is worth \$2 per ton, and separator skim milk 14 cts. per hundredweight.

Separator skim milk was compared with gluten and linseed meal for balancing a grain ration, using 2 lots of 6 pigs each. Both lots were fed a basal ration of hominy chop and ground-corn shives during the test which covered 121 days. The average daily gain of the pigs fed the ration containing skim milk was 1.54 lbs., and of the pigs fed the ration containing gluten and linseed meal, 1.12 lbs. The cost of a pound of gain in the 2 cases was estimated at 3.5 and 2.51 cts., respectively.

Four tests are reported with young pigs weighing from 36 to 61 lbs. each on the value of ground-corn shives, *i. e.* "new corn product." This material was fed as a partial substitute for hominy chop in the first test, as a substitute for part of the mixed-grain ration in the second test, as an addition to grain and skim milk in the third test, and in the fourth test as a partial substitute for hominy chop, with linseed meal and gluten meal during the last 3 months of a 5 months' trial. Skim milk formed part of the ration in every case. In the first of these tests the average daily gain per pig on the ration with corn shives was 1.37 lbs.; on the ration without corn shives, 1.43 lbs. The author calculates that the ground-corn shives were worth from \$3.40 to \$6.58 per ton, as shown by the returns in pork. The cost of this material is stated to be \$11 per ton. In the second test the average daily gain per pig on the ration containing corn shives was 1.3 lbs.; on the ration without corn shives, 1.63 lbs.; the cost of a pound of gain in the 2 cases being 2.96 and 2.57 cts. In the third test the average daily gain per pig of the lot fed the ration without corn shives was 0.81 lb.; the cost of a pound of gain, 3.21 cts. The average daily gain per pig in the lots fed corn shives varied from 0.87 to 0.94 lb. and the cost of a pound of gain from 3.26 to 3.36 cts., the largest gain but at the greatest cost being made on the ration containing the least amount of corn shives.

In the fourth trial the average daily gain per pig in the 2 lots fed a ration with linseed meal during the first period was 0.99 and 0.98 lb., respectively, the cost of a pound of gain being 2.7 cts. The average daily gain of the 2 lots fed during the same time a ration with gluten meal was 0.8 and 0.85 lb., respectively, the cost of a pound of gain

in each case being 2.13 cts. When corn shives was substituted for part of the hominy chop in the linseed-meal ration during the second period, the average daily gain was 0.73 lb. per pig, as compared with 0.53 lb. in the lot receiving no corn shives. The cost of a pound of gain in each case was 4.56 cts. When corn shives were substituted for part of the hominy chop in the gluten-meal ration in the second period, the average daily gain per pig was 0.78 lb. as compared with 0.85 lb. for the lot receiving no corn shives, the cost of a pound of gain being 2.91 cts. in both cases.

Though the method is not explained, the author makes the following calculation:

"With the linseed ration the fodder [ground-corn shives] showed an estimated value of $28 per ton, and with the gluten ration an estimated value of $20 per ton. If the fodder is not taken into consideration, the average cost for producing 100 lbs. of gain with the linseed ration was $4.18, and with the gluten ration $2.70."

The value of cowpea pasture, artichoke pasture, and sweet potatoes in addition to a ration of grain and skim milk with and without corn shives was tested with 6 lots of 5 pigs each. Lot 1 was fed ground-corn shives, grain, and during the last 4 months of the test skim milk also; lot 2 was fed the same ration except that for the last 2 months of the trial sweet potatoes and sweet-potato strings were fed. Lots 3 and 4 were fed the same ration as lot 1 for part of the test, and were then pastured on cowpeas from 2 to 4 weeks, and finally were given the run of a plat of artichokes. Lots 5 and 6 were fed at first a ration of grain and skim milk; later lot 6 was turned into a cowpea pasture, and, during the last month of the test, was fed sweet potatoes in addition to gluten meal and skim milk. Lots 1 and 2 were fed 5 months, lots 3 and 4, 4 months, and lots 5 and 6, 3 months. The average gain of the pigs in lot 1 was 108.8 lbs., and the cost of a pound of gain, 3.32 cts. The pigs in lot 2 gained on an average 71.6 lbs., the cost of a pound of gain being 3.24 cts. when fed milk and grain. When fed sweet potatoes, over 100 lbs. were required per pound of gain, which would make the potatoes worth about $1.60 per ton. In the author's opinion, sweet potatoes were not an economical feed, possibly because the pigs were too large. With the pigs in lot 6, which were somewhat younger than those in lot 2, they were found to have a value of $2.40 per ton. On cowpeas, the pigs in lots 3, 4, and 6 gained on an average 6, 31, and 49 lbs. respectively. In the author's opinion, cowpeas are better adapted to young pigs than to older pigs. The composition of the artichokes fed is reported, but the results obtained are not spoken of at length.

The results of the individual tests are discussed in considerable detail. Some of the deductions follow:

"It would seem to be desirable to mix with hog rations some material as a substitute for grazing when feeding pigs in confinement, or if it is not possible to have a material

that will mix well with the grain ration, finely cut fodder or other vegetable material may serve equally well as a substitute. Finely cut or ground clover or pea-vine hay would possibly be a better coarse feed for pigs than the ground food [*i. e.* corn shives] used in these tests, as they contain more nitrogenous food matter and are also more easily digestible."

The dietetics of bread and butter, J. HEMMETER (*Dietet. and Hyg. Gaz., 16 (1900), No. 4, pp. 207, 208*).—An abstract of an article published in the Maryland Medical Journal. The digestibility of bread and butter in combination is discussed as well as other points.

Nutritious bread (*British Food Jour., 2 (1900), No. 15, pp. 68, 69*).—A note on a special process of grinding grain and making bread which has been successfully employed in Paris.

The nutritive value of margarin as compared with that of butter, P. MOREAU (*Jour. Hyg., 25 (1900), No. 1218, p. 27*).—A summary of the work of E. Bertarelli (E. S. R., 11, p. 375).

What chemistry finds in feeds, F. H. HALL, W. H. JORDAN, and C. G. JENTER (*New York State Sta. Bul. 166, popular ed., p. 6*).—A popular bulletin on the composition and analysis of feeding stuffs (see p. 169).

How far can sugar be recommended as a feeding stuff, F. LEHMANN (*Fühling's Landw. Ztg., 49 (1900), Nos. 1, pp. 17–22; 2, pp. 57–61; 3, pp. 88–90*).—The author summarizes a number of feeding experiments which have been made with sugar.

Feeding animals on wheat, M. VACHER (*Rev. Sci. [Paris], 4. ser., 13 (1900), No. 3, pp. 93, 94*).—A brief statement before the Société d'Agriculture on the value of wheat as food for animals, with discussion.

Advantages of compressing fodders, M. RINGELMANN (*Semaine Agr., 20 (1900), No. 974, pp. 14, 15*).—The author discusses the advantages of pressing hay and straw, giving statistics regarding cost of transportation, etc.

A review of the methods of utilizing yeast as a nutritive material, L. MARCAS (*L'Ing. Agr. Gembloux, 10 (1900), No. 6, pp. 429–438; abs. in Belg. Hort. et Agr., 12 (1900), No. 4, p. 58*).—The different methods proposed for utilizing waste yeast from breweries as a food for man and animals are reviewed.

Contribution to the study of the behavior of milk sugar in the body, especially in the intestines, E. WEINLAND (*Ztschr. Biol., 38 (1899), pp. 16–62*).—Experiments are reported with young and old domestic animals and a newborn child. In some of the experiments the respiratory quotient is reported. From his investigations the author concludes that in the small intestine of newborn mammals, including man, lactase is present. The lactase was also found in the intestine of the adult dog, pig, and horse, but not in the small intestine of the adult steer, sheep, rabbit, or chicken. Other conclusions regarding the experiments are also drawn.

The value of milk protein for the formation of muscular tissue, W. CASPARI (*Ztschr. Diätet. u. Phys. Ther., 3 (1899), No. 5, pp. 393–412*).—Experiments with dogs and man are reported, in which the balance of income and outgo of nitrogen was determined to learn the food value of plasmon, a prepared food made from casein.

Concerning plasmon (caseön) as a substitute for albumen, together with notes on the metabolism of protein, E. PLOCH (*Ztschr. Diätet. u. Phys. Ther., 3 (1899), No. 6, pp. 482–505*).—The balance of income and outgo of nitrogen was determined in a number of cases.

Fat diet and stomach motility, H. STRAUS (*Ztschr. Diätet. u. Phys. Ther., 3 (1899), No. 3, pp. 198–210, fig. 1; 4, pp. 279–289, fig. 1*).—Experiments in which the balance of income and outgo of nitrogen was determined. The conclusion was reached that giving large quantities of milk fat did not harm in any way the stomach motility.

The influence on metabolism and circulation of omitting water from the diet, W. STRAUB (*Ztschr. Biol., 38 (1899), No. 4, pp. 537–566*).—Experiments with

dogs are reported, in which the balance of income and outgo of nitrogen was determined. In one case the carbon dioxid and water in the respired air were also determined. The principal conclusions follows: Omitting water from the diet increased the cleavage of protein in the body and had no effect on the cleavage of fat. When it does not produce pathological symptoms it is without effect on the blood pressure. The effect on protein of the withdrawal of water from the tissues is noticeable until the body regains its normal water content. Omitting water from the diet affects in a slight degree the amount of water excreted through the lungs and skin.

The physiological action of electric currents of high tension and great frequency, N. SPASSKI (*Physiologiste Russe, 1 (1899), No. 15-20, pp. 235-241, pl. 1*).—A form of apparatus for measuring and analyzing the respiratory products, devised in connection with the investigation, is described and experiments with guinea pigs reported.

The heat of combustion of meat of different animals, STUDENSKY (*Russ. Arch. Patol. Klin. i Bakt., 7 (1899), p. 305; abs. in Physiologiste Russe, 1 (1899), No. 15-20, pp. 303, 304*).—Experiments showed that the heat of combustion of the flesh of horses, sheep, and foxes varied very little and was on an average 5,738 calories per gram ash-free flesh.

The determination of animal heat by direct calorimetric methods and by means of the metabolism of material, P. P. AVROROV (*Russk. Arch. Patol. Klin. i Bakt., 7 (1899), p. 207; abs. in Physiologiste Russe, 1 (1899), No. 15-20, pp. 301, 302*).—A water calorimeter is described which measures directly the heat produced by an animal. Devices are also described for the measurement and analysis of the respiratory products.

Improvement of pasture as determined by the effects on the stock, W. SOMERVILLE (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 12 (1900), pp. 75-97*).—A discussion of experiments abstracted from another source (E. S. R., 12, p. 75).

Canadian experiments in animal growth and dairy products, W. BROWN (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 12 (1900), pp. 137-161, fig. 1*).—A general discussion based on the experiments of the Canadian experiment stations in animal feeding and dairying.

Contributions to our knowledge of the physical properties of Swedish wool, G. SELLERGREN (*K. Landt. Akad. Handl. Tidskr., 38 (1899), Nos. 5-6, pp. 344-390, figs. 30*).—The author gives a historical account of Swedish sheep raising, a description of the various breeds of sheep with reference to the quality of the wool, methods and apparatus used in wool examinations, and the results of the investigation. Sixty samples of wool were examined in all, according to crimp, fineness, length, elasticity, strength, color, and microscopic appearance. Among the breeds represented were Merinos, Cheviots, Southdowns, Dishleys, Oxfordshire Downs, and native sheep.

The value of succulent foods for swine, C. S. PLUMB (*Reprint from Breeders' Gaz., 1899, Dec. 20 and 27; 1900, Jan. 3, pp. 16*).—The author summarizes briefly the results of a large number of experiments on the value of roots, etc., for swine.

The preparation of feed and the feeding of swine, J. KÄPPELI (*Jahresber. Landw. Schule Rütti, 1898-99, pp. 61-67*).—From a feeding and slaughter experiment with 2 lots of 3 pigs each, the conclusion was drawn that animals fed uncooked whole grain (barley and corn) in the first month of the test consumed less feed than those receiving meal ground from the same grains moistened with hot water. Pigs fed whole and raw grain increased much more rapidly until they were 9 months old than those fed soaked meal, while during the last six weeks of the test the increase was somewhat less.

Pig raising in Tunis, J. A. TOURNIÉROUX (*Bul. Dir. Agr. et Com., 5 (1900), No. 14, pp. 68-74, fig. 1*).—Pigs and pig raising under local conditions in Tunis are discussed.

Zebra hybrids (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 12 (1900), pp. 385-388*).—A brief summary of J. C. Ewart's experiments.

Poultry raising in connection with fruit culture, M. AAMOT (*Tidsskr. Norske Landbr., 7 (1900), No. 1, pp. 27-37*).

Poultry at Geneva Experiment Station, S. F. HAXTON (*Reliable Poultry Jour., 7 (1900), No. 1, pp. 46-49, figs. 7*).—A description of the station poultry house and of a number of experiments.

Oyster culture in France (*Sci. Amer. Sup., 49 (1900), No. 1258, p. 20169*).—Quoted from the Journal of the Society of Arts.

Oyster culture in France, A. W. TOURGÉE (*U. S. Consular Rpts., 62 (1900), No. 233, pp. 182, 183*).—Oyster raising and greening in France are described.

DAIRY FARMING—DAIRYING.

Effect of a number of oil cakes on the yield and composition of milk and the live weight of milch cows, C. MOSER and J. KÄPPELI (*Jahresber. Landw. Schule Rütti, 1898-99, pp. 48-60*).—This experiment was made with 7 cows and covered 6 periods of about 15 days each. Two of the cows were regarded as checks and received a uniform ration throughout the experiment. The others received in different periods 2 kg. each of sesame cake, peanut cake, and linseed cake, and 1½ kg. of cotton-seed meal. The authors conclude that a beneficial effect was quite uniform with all of the oil cakes, the fluctuation in milk yield and live weight in different periods being greater than in the case of the control cows. While there was a small increase in live weight on sesame cake, linseed meal, and cotton-seed meal, there was an average loss of 5 kg. per cow on peanut cake. It is suggested that this may possibly have been due in part to a too narrow ration being fed during that period. With respect to the effect on the yield of milk the cotton-seed meal exceeded all others.

The authors believe that the experiment shows an undoubted superiority of cotton-seed meal over the other oil cakes in common use, and state that this conclusion is in accord with the experience of many extensive feeders in Germany.

Notes on sour milk, H. D. RICHMOND and J. B. P. HARRISON (*Analyst, 25 (1900), May, pp. 116-124*).—*Determination of the specific gravity of sour milk.*—The authors have employed a slight modification of Weibull's method (E. S. R., 5, p. 644) of adding a known volume of ammonia and correcting the reading for the ammonia added. They tested the use of caustic soda in the place of ammonia, as suggested by De Koningh (E. S. R., 11, p. 211). It was found in experiments with different acids that "although neutralization of an acid by soda always produces a loss of density, the figure varies not only with the acid, but also with the hydrogen atom neutralized by a polybasic acid. For this reason it is useless to apply any theoretical correction for milk. . . . With strong acids the change of density on neutralizing with ammonia is very much smaller than with soda, and in the opposite direction, and our results with milk indicate that it may practically be neglected."

The point at which milk may be considered sour and the rate of souring in the presence or absence of preservatives.—Stokes (E. S. R., 3, p. 195) states that milk which has not reached an acidity of 0.3 per cent of lactic acid (33.3°), or near it, will coagulate on boiling. The authors made a series of experiments, the results confirming almost absolutely the figures of Stokes. They found that milk tastes sour, on an average, when it has an acidity of 45°, although the variations are fairly wide. Fresh milk is stated to have an acidity of 20°; when the acidity reaches 33° the milk curdles on boiling.

"It is quite certain that the 'acidity' of milk is not wholly due to lactic acid; indeed, the 'acidity' of fresh milk is due to the mono- and di-basic phosphates, and not to free acid at all. Seeing that 9.7 cc. $\frac{N}{10}$ lactic acid will curdle milk on boiling, while it requires a development of about 13° 'acidity,' it is highly probable that another acid very much weaker than lactic is produced, and we venture to think that carbonic acid is responsible for a portion of the acidity of sour milk; we know that carbonic acid is produced, and we have found that when milk is sufficiently sour to develop gas about half the acidity, as indicated by phenolphthalein, is shown to litmus (to which both milk and carbonic acid are approximately neutral).

"We have based a hypothesis on the facts that different acids do not give the same result, that salts of polybasic acids are present in milk, that both casein and albumin have acidic functions, and that the coagulation of milk at temperatures between 17 and 35° does not appreciably vary with the temperature; it appears to us that curdling of milk is due to an amount of acid being present to set up an equilibrium between the acids and bases present, such that certain acids, e. g., casein and albumin, are liberated. At a boiling temperature we are inclined to think that the curdling is determined by the coagulation of the albumin, the equilibrium being destroyed by the removal of one acid (albumin) from solution, and fresh amounts of albumin, and finally perhaps casein, are liberated.

"When milk tastes sour, it would appear that the equilibrium is such that a sour-tasting free acid exists in solution; while when milk curdles spontaneously the equilibrium is such that the insoluble acid casein is produced."

Experiments were made to determine the rate of souring of milk with and without the addition of preservatives (boric acid or formaldehyde).

"At high temperatures (say 80° hot summer weather) preservatives are comparatively useless unless added in relatively large quantities; the minimum quantities used by us, and also by Rideal, only increase the life of milk a few hours, and are equivalent only to a lowering of temperature of about 5° F. Unless milk can be made to keep at least 12 hours longer than without preservatives, we do not think much is gained by their use, and to do this in summer we think that the minimum amounts are 0.09 per cent boric preservative and 0.004 per cent formaldehyde.

"We would also draw attention to the increased rate of souring as time goes on, when preservatives are added. This indicates a possible danger in using preservatives in milk, as it seems far from improbable that succeeding generations of micro-organisms become in the presence of preservatives more active and more virulent, and if the use of preservatives were universal, there is a probability that they would cease to act. The work of Effront on yeast grown in the presence of sodium fluorid shows that this view is not a mere hypothesis."

Changes in the constants of butter fat as a result of feeding, A. RUFFIN (*Ann. Chim. Analyt. et Appl., 4 (1899), pp. 383–385; abs. in Chem. Centbl., 1900, I, No. 1, p. 69*).—The author discusses the investigation of Baumert and Falke (E. S. R., 10, p. 685), in which he finds numerous analytical anomalies. He reports the following results from feeding experiments with different kinds of oil cakes:

Physical constants of butter on different feeding stuffs.

	Index of refraction.	Saponification number.	Volatile fatty acids.
Normal ration, hay, and alfalfa	30 –33	224 –232	27.6–34.9
Cotton-seed cake	28.5–30	222 –228	26.4–29
Cotton-seed cake and normal ration	29.5–30	221 –229	28.4–30
Peanut cake	30 –31	225 –228	26.9–29
Peanut cake and normal ration	28 –30	221.9–229	28 –32
Cocoanut cake	32 –33	231 –240	25.5–31

The author remarks that in practice the effects of the different feeding stuffs used largely neutralize each other, so that butter made from feeds which produce an abnormal product is rarely found on the market.

Butters from various countries compared, C. ESTCOURT (*Analyst, 25 (1900), May, pp. 113–116*).—The author has examined within the past year 250 samples of butter from different countries which were received direct from the importers. The water content was found as follows:

Water content of butter from different countries.

Origin of samples.	Number of samples.	Water content.		
		Average.	Highest.	Lowest.
		Per cent.	*Per cent.*	*Per cent.*
Finnish	85	12.3	18.0	8.0
Danish	89	13.5	18.0	9.0
Irish	39	14.1	20.0	9.0
Swedish	14	13.75	17.8	11.8
Canadian	10	13.2	19.4	10.0
German	8	13.5	14.8	11.4

Only 9 of the Danish samples and 3 of the Finnish samples contained more than 15 per cent of water. Nearly all of the samples were examined for preservatives. None of the German or Swedish samples contained preservatives, and only one sample from Canada, one from Finland, and 3 from Denmark. The preservative in these cases was boric acid, which did not exceed 9 gr. per pound. All of the 37 samples of Irish butter examined contained boric acid in quantities varying from 5 to 46 gr. to the pound.

The volatile acids were determined by the Reichert process. Only 8 of the Finnish butters gave a Reichert figure of 16 or over, and 21 samples showed less than 13, 2 of these being 11.9. Only 4 of the Irish and Canadian butters were below 13. Of the Danish samples,

22 were above 16 and only 3 were below 13. The lowest samples of Swedish and German butter showed 13.7 and 13.5, respectively.

A study of the cause of mottled butter, C. F. DOANE (*Maryland Sta. Bul. 64, pp. 43–54*).—Experiments were conducted to test various theories as to the cause of mottled butter.

The butter from each of 5 churnings was divided into 2 lots, one of which was washed with water at 50° and the other with water at 35 to 40°. The washing occupied about 1 minute. A portion of each lot was worked 3 minutes and the remaining portion 4 minutes. Of the 5 lots washed with water at 50° and worked 3 minutes one was slightly mottled. Of the 5 lots washed with cold water and worked the same time 4 were mottled. The more frequent occurrence of mottled butter in the latter case is attributed to the less thorough working of the harder butter resulting from washing in ice water. None of the butter worked 4 minutes was mottled. In 4 additional experiments to determine the effect of using cold water the butter was allowed to remain in water at 40° for 15 minutes, after which one-half of each churning was worked 3 minutes and the other half 4 minutes. The butter worked 4 minutes was free from mottles in every case; that worked 3 minutes was slightly mottled in 2 of the tests. No material difference was observed between washing 1 minute and 15 minutes.

To determine the effect of the uneven distribution of salt the butter from each of 20 churnings was divided into 2 lots immediately after washing. One lot in each case was salted and the other left unsalted. Both lots were worked one minute and then set in the refrigerator. "Not one of the unsalted lots was at all mottled, while in every case the salted lots were very distinctly mottled." It was found by tasting that the light portions of the mottled butter contained very much less salt than the more deeply colored portions. The same difference was observed in a large number of samples of unevenly colored butter from commercial sources. The author therefore concludes that the uneven distribution of salt is the cause of mottles.

The effect of salt on the appearance of butter was further tested in 5 experiments, in each of which 2 lots of butter from the same churning were thoroughly worked and otherwise treated alike except that only 1 lot in each case was salted. The salted butter had a darker color than the unsalted butter, the difference being distinguishable immediately after working and very marked after 24 hours.

To determine if the more pronounced color of the salted butter was brought about by the action of salt in driving out more of the buttermilk, the content of casein in the samples of butter made in the experiments last noted was determined. In 3 churnings the salted butter had less casein than the unsalted butter, and in the other 2 comparisons the results were reversed. In each of 10 experiments 1 lot of butter was salted and worked without being washed and another lot

from the same churning was washed thoroughly to remove as much of the buttermilk as possible. In each case the butter was worked 1 minute. At the end of 24 hours all the lots were mottled alike. The results are considered as showing that a relative excess of casein is not the cause of the lighter color of unsalted butter as compared with salted butter, nor of the lighter portions of mottled butter.

Butter worked under different conditions sufficiently to secure an even distribution of the salt was scored by an expert as to grain. One churning was washed with water at 50° and another with water at 38 to 40°, both churnings being worked immediately after washing. Two other churnings were washed with water at 45°, one receiving 2 partial workings separated by an interval of 24 hours and the other being kept in a refrigerator 24 hours before being worked. The average score for grain in 3 repetitions of this experiment was highest for the butter washed with water at about 40° and worked immediately and lowest for the butter worked after 24 hours. Butter washed with water at 50° and worked immediately scored practically the same as that given 2 partial workings.

The effect of cold wash water on the solidity of the butter was also tested. The butter from each of 10 churnings was divided into 2 lots, 1 lot in each case being washed with water at 50 to 52°, and the other lot with water at 35 to 40°. Samples of the butter from both lots in each experiment were kept at 70° and also at 48° for 24 hours. All samples were then kept at 60° for 4 hours, when they were gradually heated to 80°. There was on the whole no practical difference in the 2 lots of samples as regards the time of becoming soft or the consistency of the butter at the end of the experiment.

Bacteria content of Finnish milk, O. v. HELLENS (*Nord. Mejeri Tidn., 14 (1899), Nos. 43–46, pp. 587–589, et seq.*).—The milk supply of the city of Helsingfors was studied by the author from a bacteriological standpoint. Samples of market milk and that sold at retail stores were taken in the summer and in the winter. The samples taken during summer contained from 20,000 to 34,300,000 bacteria per cubic centimeter, the average being 4,745,000; while in the winter the bacteria content ranged from 70,000 to 18,630,000, and averaged 2,111,000. About 60 per cent of the summer samples contained over 1,000,000 bacteria per cubic centimeter against 35 per cent in the winter samples. The qualitative bacteriological examinations were restricted to pathogenic forms of bacteria, injections of new milk or cream and separator slime being made in guinea pigs. Of 34 samples, 24 were found to contain one or more forms of pathogenic bacteria. Seven different forms were identified, viz, *Bacillus tuberculosis*, *B. streptococcus pyogenes*, *B. staphylococcus pyogenes aureus*, *B. albus*, *B. citreus*, *B. bovis*, and *Bacterium coli commune*.

The examinations of the quantities of dirt in the milk showed that 35 samples out of a hundred contained less than 0.5 mg. per liter, and the average amount for 65 samples was 2.44 mg. The maximum content obtained was 10.6 mg. This favorable result is explained by the fact that on most Finnish dairy farms strict attention is paid to cleanliness in the stables and grooming the cows. The samples of milk examined were found to contain a very low percentage of fat; in the case of 100 samples only 68 came above 2.7 per cent. This is due to skimming or admixture of skim milk.—F. W. WOLL.

The invasion of the udder by bacteria, A. R. WARD (*New York Cornell Sta. Bul. 178, pp. 260–280, pl. 1, figs. 2, dgm. 1*).—The views of several investigators regarding the presence or absence of bacteria in the normal udder are noted, and investigations conducted by the author in continuation of earlier work (E. S. R., 10, p. 1094) are reported.

Bacteriological examination was made of the udders of 19 cows, slaughtered on account of tuberculosis. None of the udders examined showed tubercular or other lesions. Plate cultures were made from the fore milk drawn just before the cows were killed and from glandular tissue of different portions of the udder, great care being taken to prevent contamination. Bacteria, for the most part micrococci, were found in nearly all cases, and summaries are given of the morphology, staining reactions, and cultural characteristics of the several kinds. The same kinds of bacteria were frequently found in the fore milk and in the glandular tissue. The germs isolated from the udders did not usually cause the souring of milk in cultures. Tables and diagrams show the sources of the different germs and their distribution in a number of the udders examined.

A study of the structure of the udder revealed no obstruction separating the milk cistern from that of the teat sufficient to prevent the invasion of bacteria.

"The free communication of the milk cistern with the more minute lactiferous ducts is at times interrupted by the sphincter muscles described by anatomists as present in those ducts. There is little ground, however, for considering them as serious barriers to the progress of micro-organisms $\frac{1}{25000}$ of an inch in diameter.

"That the milk ducts of the teat normally harbor bacteria is admitted by all. Some few, with whom the writer agrees, assert that the milk cistern normally harbors bacteria. Such being true, there is little reason to doubt that bacteria may find their way through the fine ramifications of the milk cistern (lactiferous ducts) to regions remote from the teat. Pathogenic organisms certainly do so when the udder is diseased, and to conceive that harmless ones do so in health is not difficult."

The author briefly discusses the practical bearing of the results of the investigation.

"Judged from the standpoint of the dairyman, who considers that souring is the one and only harmful change in milk, the contamination of milk from the interior of the udder, so far as has been shown in this work, might be disregarded as unimportant. Until more is known of the ordinary and of the occasional bacterial

inhabitants of the udder and of their ability to elaborate enzyms and toxic substances, the writer urges the recognition of that source of the contamination of milk."

Lessons from a milk record, R. SHANKS (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 12 (1900), pp. 99–112*).—The author discusses the keeping of milk records, giving suggestions for weighing the milk, taking samples, and testing. The average yields of milk and fat of a herd of 25 to 30 cows for 5 years are given, together with notes on the system of feeding. Deductions are drawn from the record concerning the yield and quality of milk as affected by the age of the cows, abortion, character of food, and manner of milking. Young cows gave the richest milk and old cows the largest yield. Abortion lowered the yield of milk very decidedly and decreased the fat content over 0.2 per cent. Food is considered as having little or no permanent influence on the quality of the milk. The average results with 7 cows indicated that a good milker obtained a higher percentage of fat in the milk than a poor milker. Notes are given on the selection of a profitable cow.

Winter feeding for dairy cows, W. SOMERVILLE (*County Councils Cumberland, Durham, and Northumberland, Tech. Education, Rpt. 8 (1899), pp. 95, 96*).—A brief note on the rations fed dairy cows at Newton Rigg Penrith.

The college herd, C. W. BURKETT (*New Hampshire Sta. Bul. 68, p. 156*).—A tabulated summary of the herd record from November 1, 1898, to October 31, 1899.

"The herd has been equivalent to 323 milch cows and 65 dry cows for one month, and has produced 166,728 lbs. of milk and 8,864.57 lbs. of butter, making an average monthly yield per head for 388 cows, 429 lbs. of milk and 22.8 lbs. of butter, or 5,148 lbs. of milk and 273.6 lbs. of butter for the year."

On the influence of the milking on the production of the cows and the quality of the butter, K. N. KRISTENSEN (*Norsk Landmandsblad, 18 (1899), No. 44, pp. 536–539*).

The milk supply of large cities, BOYSEN (*Milch Ztg., 29 (1900), No. 6, pp. 81–83*).—A discussion of the milk supply of Copenhagen based on observations made by the author.

Experiments in the purification of milk, DUNBAR and I. KISTER (*Milch Ztg., 28 (1899), Nos. 48, pp. 753–756, figs. 3; 49, pp. 771–773; 50, pp. 787–789*).—Comparative tests of a centrifuge and a Danish sand filter with especial reference to the removal of dirt and bacteria and changes in the character of the milk are reported in detail.

Preservation of milk samples for the purpose of investigation, H. SCHROTT (*Milch Ztg., 29 (1900), No. 12, p. 180*).—The method of pasteurization practiced by the author in preserving a series of samples of milk for a composite test is described. The milk was kept at a temperature of 70 to 82° C. for 1 to 2 hours. Each day an equal portion was added to the first sample and the pasteurization repeated. Composite samples covering 14 days were secured without difficulty in this way.

Sampling milk and cream (*Vermont Sta. Spec. Bul., Oct., 1899, pp. 4*).—Detailed directions are given for taking samples of milk to test individual cows and the entire dairy as a whole, to test cream and skim milk from the dairy, to test buttermilk or whey, and to check correctness of test at creamery or cheese factory.

A modification of the Babcock milk test, M. SIEGFELD (*Dairy World, 20 (1900), No. 6, p. 18*).—The milk and sulphuric acid are mixed as usual and 2 cc. of amyl

alcohol and a sufficient quantity of hot diluted sulphuric acid (temperature 90–100° C. and sp. gr. 1.5) to fill the test bottle to the upper part of the graduated neck are added. The samples are whirled 3 minutes and the reading taken. Only one whirling is required. Determinations made by this method agreed closely with those made by the Gerber test and the Adams gravimetric method.

The relation between specific gravity, fat, and solids-not-fat in milk, N. LEONARD (*Analyst, 25 (1900), Mar., pp. 67–69*).—The author worked out the average error in the calculation according to a formula, and found that the error varied with the season.

On the payment for milk according to the content of solids, H. SCHROTT (*Milch Ztg., 29 (1900), No. 5, pp. 68–71*).—This subject is discussed at some length.

Bitter milk for infants, UHL and O. HENZOLD (*Milch Ztg., 29 (1900), No. 5, pp. 65, 66, fig. 1*).—The cause of a bitter taste in samples of prepared milk from 2 factories was traced to a species of Clostridium present in the milk sugar which was added in the process of manufacture. The bacterium is illustrated and described. It was not found in a sample of milk sugar containing no albuminous substances.

Notes on the control of the manufacture of butter (*Belg. Hort. et Agr., 12 (1900), No. 2, pp. 28, 29*).

Some contributions on the rancidity of butter, J. HANUS (*Ztschr. Untersuch. Nahr. u. Genussmtl., 3 (1900), No. 5, pp. 324–328*).

Stilton cheese making, M. BENSON (*Agr. Jour. and Min. Rec., 2 (1900), No. 24 pp. 749–754*).

VETERINARY SCIENCE AND PRACTICE.

Immunization against Texas fever by blood inoculation, W. H. DALRYMPLE, W. R. DODSON, and H. A. MORGAN (*Louisiana Stas. Bul. 57, 2. ser., pp. 143–185, figs. 6*).—In experiments in blood inoculation, 9 susceptible heifers were divided into 3 groups and each group was inoculated with the blood of a different animal. The animals from which blood was taken for inoculation were an immunized steer from north of the quarantine line, a native animal, and a Jersey calf born on the college grounds. Five cubic centimeters of blood from these animals was inoculated into each of the 9 animals to be immunized. The blood from the Jersey calf produced fever in the 3 heifers into which it was inoculated and caused a decrease in the number of blood corpuscles. The 3 heifers were afterwards exposed to natural infestation with ticks without developing acute cases of Texas fever. The other 2 animals from which blood was taken for inoculation were believed to have recovered from more severe attacks of Texas fever and to possess, therefore, blood of greater immunizing power. The 3 heifers which were inoculated with blood from the native animal developed high temperatures and showed a decrease in the number of blood corpuscles, as usual under such conditions. During the inoculation fever, one of the animals was attacked by 2 healthy animals and died as a result. Similar results were obtained from the blood of the immune Northern steer. It was observed, however, that the blood of this steer was less virulent than that of the native steer, but that its immunizing properties were fully as satisfactory. Two Herefords

were each inoculated with $2\frac{1}{2}$ cc. of blood from a recently immunized animal, with entirely satisfactory results. Mr. J. T. Bryant successfully immunized 2 Hereford yearlings (imported from Iowa) by inoculation with 2 cc. of blood from a native yearling.

The authors give a description of the method to be used in securing the blood for inoculation and in making the inoculation in animals to be immunized. Experiments were conducted for the purpose of determining whether the blood in ticks could be used for inoculation purposes. Ticks were collected and carefully washed in a solution of corrosive sublimate and sterilized water. The blood from these ticks was then used in inoculating 4 animals. The first animal (a grade Shorthorn) was inoculated with blood obtained from 3 large cattle ticks which had been removed from native cattle. The temperature of this animal showed an elevation one week after the injection, then returned to the normal, and became high again 15 days after the injection. The highest recorded temperature was 104.6° and the blood corpuscles were diminished by about one-third. The animal was placed on a tick-infested pasture in the following spring without showing any evidence of fever. The second animal (a grade Shorthorn) was inoculated on August 29. Its temperature was quite high during the 2 following days, but returned to the normal on the fourth day. Since it seemed doubtful whether the animal had really become immune, a further inoculation was made with blood taken from ticks which had been maintained for 7 hours at a temperature of — 12° C. After this second inoculation, the number of blood corpuscles diminished, but there was no temperature reaction except for one day. Later, a single tick was found on the animal, so that this case was considered too complicated for drawing definite conclusions. The third animal was a common 2-year-old steer which was inoculated with blood from ticks which had been kept for 7 hours at a temperature ranging from — 10 to — 12° C. The animal developed no symptoms of Texas fever for 18 days after the inoculation, and was then inoculated with blood from a native cow. One week later a good case of inoculation fever developed. It appears from this experiment that the organism of Texas fever may be destroyed or attenuated while in the body of the ticks, and this may be the explanation of the fact that tick infestation in late fall or early spring produces a milder form of the disease than that of midsummer. The fourth case was a heifer which was inoculated with the blood from ticks and developed a high fever on the nineteenth day after inoculation, the blood corpuscles being also reduced by about 50 per cent. Recovery then began to take place, but the animal became deeply mired during this time and died.

An experiment was tried in the preservation of blood for inoculation purposes. One-tenth per cent of potassium oxalate was added to blood and this blood was then sent to Ann Arbor and tried at home

after 4 days' preservation, with negative results in both cases. No bacterial growth had taken place in the blood, but the organism of Texas fever was destroyed. A cross Hereford and Shorthorn bull, 2 years of age, was imported from Missouri and inoculated in the ordinary way, but died on the third day after inoculation. It was supposed that in this case death resulted from septicæmia.

The general results of these experiments may be summarized as follows: Blood from recently immunized animals gave a milder and less protracted form of inoculation fever than a similar amount of blood from a native animal. If animals were allowed a sufficient time to recover completely from the inoculation fever, they did not suffer when exposed to tick infestation. The experiments indicate that it is possible to take engorged ticks from recently immunized animals and ship them to considerable distances, thus using them as receptacles for containing the virulent blood. It appears also that although the inoculation fever which results from the use of such blood is mild, the immunity produced is complete.

Studies on cattle plague, M. NENCKI ET AL. (*Arch. Sci. Biol.* [*St. Petersburg*], *7* (*1899*), *No. 4, pp. 303–336*).—The authors' researches upon cattle plague were begun in the province of Kouban in 1895. It was soon discovered that the blood of animals which had recovered from this disease contained a substance which confers immunity on other animals. Considerable progress has been made in perfecting means for the preparation of the antitoxin and in taking blood from experimental animals. The animals which are to be immunized receive a dose of 0.2 cc. of virulent blood. After about 2 days, when it appears that the disease has invaded the organism, the animal receives a dose of therapeutic serum. Immunization has been accomplished by the authors by 2 methods, which they have called rapid and slow, respectively.

The benefits derived from immunization are stated by the authors as follows: The danger of contagion from the excrement of the animals is avoided and abortion in pregnant cows prevented. The injection of immunizing serum has no influence upon the secretion of milk. Animals which are susceptible to cattle plague may be immunized in 3 ways, by the serum alone, by the serum and virulent blood, and by inoculating the animal with virulent blood and then giving an injection of serum after the disease has shown its first symptoms, which occurs usually in from 1 to 3 days.

In experiments which were conducted to determine the value of bile in the production of immunity, the authors came to the following conclusions: The green bile of animals killed by severing the jugular vein from 5 to 7 days after the beginning of the fever is most effective in producing immunity. The bile of animals which have died of cattle plague is yellowish in color and is not suitable for use in preventive

inoculation. Immunization by means of bile is a method which in general is too uncertain in its results to be recommended.

Results of recent investigations on foot-and-mouth disease and their practical application, C. EBERTZ (*Arch. Wiss. u. Prakt. Thierh., 26 (1900), No. 2-3, pp. 155-204*).—The author presents an elaborate critical review of the literature of this subject. A commission which was appointed for investigating vaccination methods against this disease did not carefully determine the virulence of the lymph which was used for this purpose, its value, nor the varying susceptibility of the animals which were to be inoculated.

The author considers in a critical manner the results obtained from the application of Löfler's seraphthin method and Hecker's inoculation experiments against foot-and-mouth disease. The author believes that the reports which have hitherto been made on the value of various methods in controlling this disease are to some extent vitiated by the failure to make allowance for the large number of exceedingly mild cases which are nearly always to be observed in extensive outbreaks of the disease. The author states that numerous experiments carried out under government control according to Hecker's inoculation method show that in its present form it is not adapted to the production of such results as have been claimed for it.

Sheep scab, A. W. BITTING (*Indiana Sta. Bul. 80, pp. 63-76, figs. 8*).—The author gives a general account of the nature of this disease and a description of the parasitic mite which causes the disease. Brief notes are presented on the dips to be used for the destruction of the scab mite and on the methods of applying such dips, together with a description of dipping tanks. The State statistician secured reports from sheep owners which indicate that sheep scab existed in 320 localities in the State and that 9,338 sheep were affected. Further inquiry developed the fact that some other conditions which caused roughness in the fleece had been mistaken for scab.

The bulletin contains a copy of the live-stock law of Indiana affecting the spread of sheep scab and the regulations of this Department concerning the dipping of sheep which are affected with scab.

Scab in sheep—suggestions for its eradication, WALLACE (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 12 (1900), pp. 117-137*).—The author gives statistics compiled from circulars of inquiry which show that the most serious outbreaks of sheep scab occur during the winter months. A brief outline of the life history of the scab mite is presented. On the subject of dipping, the author gives a general discussion of the peculiar local conditions which must be considered in this operation throughout Scotland and Wales. In the mountainous regions of Wales about 45,000 sheep belonging to 300 owners are grazed. These sheep are in herds of from 5 or 6 up to 2,000. These

regions are not isolated by division fences into separate areas, and it is therefore necessary that dipping should be regulated by some central authority.

Among the dipping materials considered by this author, the following may be mentioned: A white arsenic dip made by boiling 45 lbs. of arsenic and 45 lbs. of carbonate of soda crystals in 2½ gal. of water. This to be dissolved in water at the rate of 2 lbs. to 100 gal. Sulphur in the insoluble form of flowers of sulphur is recommended as an effective dip. In order that sulphur may be more evenly distributed in the dip, it is recommended that an equal weight of soft soap be added. Tobacco is recommended in a dip made as follows: 100 lbs. of dry leaf-tobacco, 10 lbs. of blue vitriol, 15 lbs. of common salt, and 2 lbs. of oil of turpentine. Carbolic acid has also been found effective in killing living parasites, but it is dangerous if used in a strength sufficient to kill the eggs. Pitch oil is not recommended on account of the injurious effects which it has upon the wool.

The author makes the following recommendations regarding dipping: The dipping season should be from the first of June to the middle of November. Counties should be subdivided into areas in which all sheep may be dipped within a period of 15 days, a second dipping to take place between the fifth and fourteenth day after the first dipping. Inspectors should be appointed by the Board of Agriculture and no sheep should be removed from one area to another during the dipping season without being dipped immediately before removal. All railway trucks and pens in public markets should be thoroughly disinfected. Dipping tanks should be provided, the total cost being met by the sheep owners. Late autumn dipping is more generally practiced than spring dipping and is most effective. It is especially desirable also from the fact that *Melophagus ovinus* is killed along with the scab mite. Spring dipping is desirable where the fall dipping has not proved successful, and is usually more or less effective in destroying the grass ticks of the genus Ixodes, and thereby preventing louping-ill.

Swine plague, P. FISCHER and A. T. KINSLEY (*Kansas Sta. Bul. 91, pp. 18*).—The veterinary department of the station is conducting experiments in protective inoculation against swine plague. Attenuated cultures of *Bacillus suis* were used as prepared by H. J. Detmers.

A college herd of 434 pigs had been bought from different localities and was divided into 2 lots containing 114 and 320 respectively. Lot 1 was inoculated July 11, 1899. Lot 2 was inoculated August 11 of the same year. On July 24, or 13 days after the inoculation of lot 1, the pigs began to die of swine plague and continued to die until October 8, when only 7 pigs remained out of the 114. On August 19, or 8

days after the inoculation of lot 2, the pigs of this lot began to die, and at the end of 45 days only 56 were left of the 320.

In order to determine whether the inoculation with Detmers' virus was the cause of the outbreak of the disease, 10 average pigs were selected from lot 2 for special experiment. The temperatures of these pigs were taken and were found to range from 104.4 to 109° F. Only one of the pigs had a normal temperature. Each of these 10 pigs received 5 cc. (10 full doses) of a check culture of *Bacillus suis*. In some of them a slight rise in temperature was noticed on the second day, as a possible effect of the lymph. In others no effect whatever was noticed. The pig which had the normal temperature at the beginning of the experiment was the only one which survived. The authors believe that all those which died were infected with swine plague before the beginning of the experiment. The observation of temperature of pigs seems to be a valuable method of diagnosing swine plague before other symptoms are manifested.

The regular dose of the virus is from 0.1 to 1 cc., but the authors found by experiment that pigs could receive 25 times this amount without permanent bad effects. It was concluded, therefore, that protective inoculation when carefully performed can not cause an outbreak of swine plague. Notes are given on an outbreak of swine plague in a herd of a farmer, from which it is apparent that pigs may be infected with swine plague for a period of 33 days before deaths begin to occur.

Nine hundred and fifty-five pigs belonging to farmers in the State have been inoculated with the Detmers virus and not one of this number has died of swine plague, although many of them have been exposed. The authors believe that the method can be so perfected as to be of considerable practical value but do not recommend its general adoption until further experiments have been conducted.

New investigations on Trichophyton minimum, LE CALVÉ and H. MALHERBE (*Arch. Parasit.*, *2* (*1899*), *No. 4*, *pp. 489–503*, *fig. 1*).—The authors give a detailed description of the dermatomycosis produced by this organism. From a study of the circumstances under which outbreaks of the disease were observed it is concluded that the fungus lives during the winter in a vegetative condition in the soil or filth of stables.

The mycelium of this organism secretes about itself a sort of substance of a mucoid nature. Some experiments were conducted to determine the chemical nature of this substance. Boiling water, dilute mineral acids, dilute bases, and dilute organic acids had no effect at all upon the mucoid matter, except in the case of acetic and hydrochloric acids, which seemed to clarify the substance. Numerous other tests were made, with the result that the substance is believed to be of a

proteid nature. The organism not only produces a disease of the skin and hair in the horse, but may be transmitted to dogs and guinea pigs. It was not observed on man and no experiments were conducted to determine the possibility of transmitting it to man.

T. minimum has a delicate, branched mycelium, with very small spores. The vegetative portions are inclosed by an external secretion of a proteid substance, which constitutes a source of reserve nutriment for the fungus. The culture media which are best adapted for growing this organism are such as contain albuminoid substances. The organism is believed to live in 2 conditions—as a parasite in the skin of the horse and dog, and in a vegetative condition during cold weather in the soil or in filth.

Notes on the mortality of incubator chicks, G. W. FIELD ET AL. (*Rhode Island Sta. Bul. 61, pp. 49–60*).—One of the most serious sources of loss in poultry raising is the death of incubator chicks, and the experiment station undertook an investigation to determine the proportion of chicks that died and the causes of death.

In the summer of 1899, 826 dead chickens from incubators were examined. Fewer males died than females, the proportion being 387 to 439. *Post-mortem* examinations indicated that the diseases of incubator chickens may be classified under 4 heads: Diseases due to heredity or environment, to mechanical causes, to imperfect sanitation, and to improperly balanced ration.

Alternate periods of heat and cold during incubation bring about a considerable percentage of abnormalities, 33 per cent of the chickens examined indicating a trouble of this origin. Diseases due to heredity may be the result of congenital weakness resulting in special susceptibility to sickness or in malformations. Tuberculosis among chickens was in several cases contracted after hatching through the infected brooder. Another sort of constitutional weakness is a failure to absorb the yolk at the proper time. Poultry raisers frequently complain of "bowel trouble" as an important cause of death among incubator chickens, and this trouble was found to be caused by the nonabsorption of the yolk, which happened in a large proportion of the chicks which died before hatching, and in 13.3 per cent of the hatched chicks abnormalities of the yolk sac were noticed.

Many deaths occurred from overcrowding or trampling and suffocation in the brooders. The fatalities due to imperfect sanitation are more important. Tuberculosis, according to the observations of the authors, was found in 15.1 per cent of the dead chicks, tubercles being found in the lungs of 113 cases, on the walls of the heart in 5 cases, on the walls of the gizzard in 5 cases, and on the intestine in 1 case. It was found that removing the "hovers" and setting them out of doors in full sunlight reduced the presence of tuberculosis to a considerable extent. The lungs were found to be congested in 243 cases or 29.4 per cent. The greatest number of deaths resulted from improper feed-

ing, 75.6 per cent manifesting abnormality in the gall bladder. In such cases the green gall stains the adjacent organs, or even the adbominal wall, and a green area is to be seen on the outside of the abdomen, close to the posterior edge of the breast bone.

Experiments were conducted to determine the hygienic effects of different rations, 219 chicks being placed in 4 pens under similar conditions. All pens were fed as much as they would eat for 30 days. One pen was fed a diet of equal parts of egg, liver, and grain, boiled together and chopped fine, with an addition of sliced onion, oat sprouts, etc. The mortality was 3.9 per cent. The second pen was fed on grain and green stuff, all animal proteid being omitted. The mortality was 9.5 per cent. The third pen was fed on grain alone, with a resulting mortality of 32.7 per cent. The fourth pen was fed on egg, liver, and green stuff, all grain being omitted. The mortality was 63.7 per cent.

The general conclusions of the bulletin may be stated as follows: Careful examination of dead chicks will usually disclose the cause of death. Death from overcrowding can be easily corrected. In order to reduce the amount of tuberculosis, the brooder should be given as much sunlight and air as possible. Disorders of the liver and gall bladder may be recognized from the green stain. In order to prevent this, more animal food should be given. Diarrhea is frequently the result of feeding a too large proportion of animal food.

The dangers of water drinking, W. O. WILLIAMS (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 12 (1900), pp. 112–117*).—The source of some of the principal dangers to live stock in contaminated water is pointed out and the importance of clean water insisted upon.

The micro-organisms in tumors, N. SJÖBRING (*Centbl. Bakt. u. Par., 1. Abt., 27 (1900), No. 4, pp. 129–140, figs. 4*).—The author made a study of 30 kinds of tumors, including carcinomata, sarcomata, and myomata. A number of experiments were conducted in transplanting these tumors from man to animals. The author concludes that the organisms which are concerned in the production of tumors have heretofore been improperly classified and belong to the Rhizopods.

On infections produced by coli bacilli, E. ZSCHOKKE (*Schweiz. Arch. Thierh., 42 (1900), No. 1, pp. 20–29*).—The author reviews the literature upon this group of bacilli and relates the evidence which he collected from personal observations to indicate that polyarthritis of calves and croupous enteritis of cats is due to the pathogenic action of organisms belonging to this group.

Combating tuberculosis in domestic animals, B. BANG (*Maanedsskr. Dyrlæger, 11 (1900), No. 10, pp. 355–388*).—An elaborate discussion of the literature of the problem, with a critical account of the various methods which have been adopted in different countries.

Treatment of anthrax with creolin, YORDAL (*Berlin. Tierärztl. Wchnschr., 1900, No. 6, pp. 63, 64*).—The disease was not checked by doses of 25 gm. creolin.

Anthrax in the dog, H. MARTEL (*Ann. Inst. Pasteur, 14 (1900), No. 1, pp. 13–25*).—Phlorizine and pyrogallol diminished the natural resisting power of the dog to anthrax. The rabid dog is very susceptible to anthrax. Anthrax bacilli by frequent passing through dogs become more virulent and undergo morphological changes, becoming shorter and thicker.

Contribution to the study of Texas fever, T. CARRASQUILLA (*Bol. Soc. Agr. Mexicana, 24 (1900), No. 5, pp. 89–94*).—An account of the symptoms, patholcgical anatomy, treatment, and prophylaxis by serum inoculations.

Texas fever, M. FRANCIS and J. W. CONNAWAY (*Texas Sta. Bul. 53, pp. 53–106, figs. 13*).—This is a report upon the cooperative work of the Texas and Missouri experiment stations and the Missouri State Board of Agriculture, published also as Missouri Station Bulletin 48 (E. S. R., 11, p. 988).

Experimental inoculation against foot-and-mouth disease according to Hecker's method (*Deut. Thierärztl. Wchnschr., 8 (1900), No. 3, pp. 11–23*).—Extensive experiments with this method indicate that it is ineffective in protecting animals against the disease and in influencing the course of the disease.

Combating foot-and-mouth disease, SCHUTZ (*Deut. Landw. Presse, 27 (1900), No. 7, pp. 63, 64*).—A general discussion of the symptoms of this disease, with recommendations of preventive measures.

Bacteriological conditions in mastitis of cows, C. O. JENSEN (*Maanedsskr. Dyrlæger, 11 (1900), No. 10, pp. 337–354*).—The forms of mastitis are classified in 3 groups—lymphogenic, hæmatogenic, and galactogenic. The bacteria which are most often found in connection with mastitis are Streptococci, Staphylococci, and Coli bacilli.

Omphalo-phlebitis of calves, BITARD and P. LEBLANC (*Jour. Med. Vet. et Zootech., 5. ser., 4 (1900), pp. 10–12, fig. 1*).—A discussion of the etiology and symptoms of this disease is given, together with various treatments which are recommended. The treatment should be preventive, and consists for the most part in a careful antiseptic treatment of the umbilical cord.

Dehorning (*Agr. Jour. Cape Good Hope, 16 (1900), No. 1, pp. 10–12*).—A table is given showing the amount of milk and butter fat before and after dehorning. Only a slight decrease was noted.

Determining the age of slaughtered cattle, BUNGE (*Deut. Landw. Presse, 26 (1899), No. 94, p. 1062*).—Quoted from the *Deutsche Thierärztliche Wochenschrift*. The author bases his determinations of the age of cattle on changes in the spinal process.

Protective inoculation against hog cholera, H. JOST (*Berlin. Tierärztl. Wchnschr. (1900), No. 4, pp. 37–39*).—A discussion of the methods to be adopted in making the inoculation.

Manifestations of disease in horses which are kept in badly ventilated stalls, SEEGERT (*Ztschr. Veterinärk., 12 (1900), No. 2, pp. 65–68*).—In badly ventilated stalls horses manifest not only a generally unsatisfactory condition, but show a special tendency toward congestion of the brain and catarrh of the respiratory organs.

The horse's foot and how to shoe it, DEWAR (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 12 (1900), pp. 239–294, figs. 32*).—This article contains detailed directions for the preparation of the hoof and the shaping of the shoe, with reference to special purposes or the correction of defects in the foot or gait.

Rabies and its prevention, LOIR (*Bul. Dir. Agr. et Com., 5 (1900), No. 14, pp. 74–78*).—A general discussion.

Caponizing cockerels (*Queensland Agr. Jour., 6 (1900), No. 1, pp. 25–27, figs. 4*).—A description of the operation and of the necessary instruments.

Bacillol, Protargol, and Tannoform, C. AUGERSTEIN (*Berlin. Tierärztl. Wchnschr., 1900, No. 6, pp. 61, 62*).—This article reports results which were obtained in antiseptic treatment. Bacillol in a 2 per cent solution gave excellent results. Protargol is expensive, but is so effective even in weak solutions that its cost is no great disadvantage. The author believes that tannoform is a better remedy than iodoform in cases where the latter would be used.

TECHNOLOGY.

Chloroform in wine making, L. E. MOLINE (*Reprint from L'Agriculture Moderne in Bol. Soc. Agr. Mexicana, 25 (1900), No. 12, pp. 236, 237*).—This article gives the method of controlling fermentation in wine making by the use of chloroform. For this purpose the chloroform is incorporated with 5 times its volume of alcohol and added to the must in the proportion of 4 or 5 cc. per liter. After some days, when the must is sufficiently colored, the wine is decanted and the pomace pressed as usual. The wine may then be pasteurized at 80° C., when the excess of alcohol and chloroform will pass off. It is claimed that this method is uniform in its action and leaves no undesirable odor or product behind, as in the use of sulphuric acid. Even if the chloroform should remain, it would produce no undesirable results. This method was found especially valuable in the treatment of champagne, as the product was of better quality and the time of maturing shortened at least one year.

On a new process for extracting sugar from low products, P. LECOMTE (*Compt. Rend. Acad. Sci. Paris, 130 (1900), No. 20, pp. 1336, 1337*).

Ozone for the purification of sugar-beet juices (*Sugar, 11 (1899), No. 12, pp. 182, 183*).—Notes on the use of electrically prepared ozone in improved methods of beet-sugar manufacture.

Verley's method of treating sirup with ozone (*Ind. Electrochim., 3 (1899), pp. 25–29; abs. in Sci. Abs., 2 (1899), No. 21, p. 630*).

Practical data for the use of sulphurous acid in beet-sugar extraction (*Sugar Beet, 21 (1900), No. 1, pp. 2–4*).

Russian electrical methods for beet juice and sirup epuration (*Sugar Beet, 21 (1900), No. 1, p. 9*).

Abnormally high polarization of some mill juices, H. C. PRINSEN-GEERLIGS (*Meded. Proefstat. Suikerriet West Java, No. 39, pp. 19*).

Annual report of the enological station of Haro, Spain, VICTOR C. MANSO DE ZÚÑIGA (*Memoria Anual Estación Enológica de Haro, July, 1899, pp. 35, map 1*).—This gives an account of the work at this station during 1899 in the following lines: Correspondence, field, and laboratory investigations on grape growing and wine making, and meteorological observations.

The manufacture of white wine from red grapes, A. BOUFFARD and L. SÉMICHON (*Ann. École Nat. Agr. Montpellier, 11 (1899–1900), pp. 155–170, fig. 1*).

New process of wine making (*Sci. Amer., 82 (1900), No. 6, p. 92*).—Methods tested in France and Tunis by which the grapes are subjected to heat and pressure instead of using them cold and allowing the juice to exude naturally. The result is claimed to be more juice, better color and "body."

Investigations on wine ferments and the use of pure cultures in wine making, V. PEGLION (*Staz. Sper. Agr. Ital., 31 (1898), No. 12, pp. 81–110, pls. 2*).

The use of selected yeasts in wine making, E. KAYSER (*Ann. Sci. Agron., 1899, II, No. 1, pp. 130–158*).

Yeasts in viticulture, M. E. POZZI-ESCOT (*Jour. Agr. Prat., 1900, I, No. 6, pp. 212–217*).

The sterilization of grape juice the solution of wine making in hot climates, C. MAYER (*Agr. Jour. Cape Good Hope, 15 (1899), No. 10, pp. 651–653*).

Wine making in Oran, G. LOEVI (*La vinification en Oranie. Paris: G. Masson, 1899, pp. 300, ill.*).—This work treats of the methods employed in making wine in the Province of Oran, Algeria.

Wine making in Russia: IV, Northern Caucasus, M. BALLAS (*St. Petersburg: Department of Agriculture, 1898, pp. XII + 256; rev. in Selsk. Khoz. i Lyesor., 192 (1899), March, pp. 701, 702*).—The total area of vineyards in the whole Caucasus is 291,000 acres, from which there are annually obtained 7,610,000 bucketfuls of wine and more than 230,000,000 lbs. of grapes. The annual export of Caucasian wine amounts to about 20,000,000 lbs.—P. FIREMAN.

Wine making in warm countries—Algeria and Tunis, J. DUGAST (*Vinification dans les pays chauds—Algérie et Tunisie. Paris: G. Carré & C. Naud, 1900, pp. 281+48, figs. 58*).

Report on the salted wines of Tunis, A. GIRARD and M. FLEURENT (*Bul. Min. Agr. [France], 18 (1899), No. 6, pp. 1157–1161*).—A number of analyses of samples of wine, including proximate and ash constituents, are reported.

Cider, X. ROCQUES (*Le cidre. Paris: Masson et Cie, 1899, pp. 171, figs. 22*).—This is a volume of *Encyclopédie scientifique des aide-mémoire.*

Cider making in Devonshire, E. A. S. (*Agr. Students' Gaz., n. ser., 9 (1900), No. 6, pp. 168–173*).—This is a brief description of the machinery and methods employed.

Cider making, O. CUISSET (*Jour. Agr. et Hort., 3 (1899), No. 8, pp. 153–155*).

Investigations into the manufacture of cider, F. J. LLOYD (*Bd. Agr. [London], Rpt. Agr. Ed. and Research, Great Britain, 1898–99, pp. 158–161*).—These investigations have extended over a number of years. The present article deals with composition of the fresh juice, manipulation of cider, fermentation, filtering, and preservatives for checking fermentation.

The manufacture and consumption of cider in Paris during 24 years (*Rev. Sci. [Paris], 4. ser., 12 (1899), No. 15, p. 479*).

Tests of the freezing of cider, DESCOURS-DESACRES (*Compt. Rend. Acad. Sci. Paris, 130 (1900), No. 1, pp. 51, 52*).

Norwegian barley for malting purposes, F. H. WERENSKIOLD (*Tidsskr. Norske Landbr., 7 (1900), No. 1, pp. 20–26*).

The preparation of casein for use in the industries, C. BESANA (*Staz. Sper. Agr. Ital., 32 (1899), No. 6, pp. 628–633*).

Apparatus for steaming and drying the cocoons of silkworms, E. VERSON (*Ann. R. Staz. Bacol. Padova, 27 (1899), pp. 97–104*).

AGRICULTURAL ENGINEERING.

Broad and narrow tires, C. M. CONNER (*South Carolina Sta. Bul. 48, pp. 16*).—An account is given of two tests (August 17 and October 3, 1899) on wet and dry sandy roads of the draft, as measured with the dynamometer, of wagons with metal wheels of standard height having tires 6 in. and $1\frac{1}{2}$ in. wide. The load in each case was 2,000 lbs., the length of run 200 ft. The results were as follows:

"In all conditions of sand roads the draft of the broad tire was from 7.49 to 28.6 per cent less than that of the narrow tire.

"There was little difference in the draft of the broad tire on wet or dry sand. The narrow tire pulls a little more than 5 per cent lighter in wet sand.

"The condition of the road was not improved by the use of the broad tire except for broad tires.

"The draft of the narrow tire was 5.73 per cent less in loose sand than in a well-formed rut of the broad tire."

The results of tests of a similar character at other stations are briefly summarized.

Report of the engineer, O. V. P. Stout (*Rpt. Nebraska State Bd. Agr. 1898, pp. 211-231*).—A record of the rates of discharge of the principal streams of Nebraska. A previous report is noted in E. S. R., 9, p. 798.

Note on the prospects of the Nile summer water supply in 1900, W. E. Garstin (*Millers' Gaz., 23 (1900), No. 44, p. 544*).—The discharge of the river in years of low supply (1878 and 1889) is compared with its present condition, and means of meeting the prospective low supply are suggested.

Irrigation in the Belgian Campine, M. Beau (*Jour. Agr. Prat., 1899, II, No. 42, pp. 558-561*).

A gaging apparatus for testing pumps, P. Ferrouillat (*Ann. École Nat. Agr. Montpellier, 11 (1899-1900), pp. 1-4, fig. 1*).

Trial of oil engines, R. Stanfield et al. (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 12 (1900), pp. 388-408, figs. 14*).—Descriptions and tests of ten machines are reported.

The future of the petroleum motor, J. Gobiet (*L'Ing. Agr., 10 (1900), No. 8, pp. 515-527*).

Compend of mechanical refrigeration, J. E. Siebel (*Chicago: H. S. Rich & Co., 1899, 3. ed., pp. XI+420*).—This is stated to be "a comprehensive digest of applied energetics and thermodynamics for the practical use of ice manufacturers, cold-storage men, contractors, engineers, brewers, packers, and others interested in the application of refrigeration." The book discusses in detail the principles of refrigeration and their practical application in ice making and storing; cold storage; refrigeration of packing houses, breweries, etc. An appendix gives the literature of the subject.

STATISTICS—MISCELLANEOUS.

Twelfth Annual Report of Kansas Station, 1899 (*Kansas Sta. Rpt. 1899, pp. XX*).—This includes the organization list of the station, reports of the treasurer and secretary on the receipts and expenditures of the station for the fiscal year ended June 30, 1899; summaries of Bulletins 81-89 of the station, with an index to the bulletins; subject lists of regular and press bulletins issued by the station, and a general review of work in the different departments.

Twelfth Annual Report of Michigan Station, 1899 (*Michigan Sta. Rpt. 1899, pp. 4, 5, 53-73, 79-367*).—Contains the organization list of the station, a report of the secretary and treasurer for the fiscal year ended June 30, 1899, a report of the director, and departmental reports reviewing the different lines of station work during the year, a meteorological summary noted elsewhere, and reprints of Bulletins 161-174 of the station on the following subjects: Fertilizer analyses (E. S. R., 10, p. 734); relation of meteorology to forestry in Michigan, sketch of the original distribution of white pine in the lower peninsula, the present condition of Michigan forest and stump lands, forestry legislation, and methods of reforesting pine stump lands (E. S. R., 10, pp. 1020, 1045, 1046); strawberry culture (E. S. R., 10, p. 1043); methods and results of tillage (E. S. R., 11, p. 40); draft of farm implements (E. S. R., 11, p. 96); a grade dairy herd (E. S. R., 11, p. 188); a discussion of farm dairy methods (E. S. R., 11, p. 186); Michigan fruit list (E. S. R., 11, p. 153); notes from the South Haven Substation (E. S. R., 11, p. 252); vegetable tests for 1898 (E. S. R., 11, p. 250); bush

fruits for 1898 (E. S. R., 11, p. 252); combating disease-producing germs (E. S. R., 11, p. 390); killing the tubercle bacillus in milk (E. S. R., 11, p. 386); fertilizer analyses (E. S. R., 11, p. 528).

Eleventh Annual Report of New Hampshire Station, 1899 (*New Hampshire Sta. Bul. 68, pp. 143-194, figs. 2*).—This contains the organization list of the station, a financial statement for the fiscal year ended June 30, 1899, reports of the vice-director and chemist, horticulturist, agriculturist, entomologist, bacteriologist, and meteorologist, parts of which are noted elsewhere, and a list of station publications available for distribution. The report of the vice-director and chemist gives the results of analyses of several samples of city stable manure, spring water, and wood ashes.

Director's report for 1899, W. H. JORDAN (*New York State Sta. Bul. 168, pp. 307-330*).—The different lines of station work with the results obtained are reviewed at some length, and notes are given on the station staff, student assistants, needed changes and additions, inspection of fertilizers and feeding stuffs, and the publications of the station. Lists of bulletins published in 1899, and periodicals received by the station library are appended.

Eighteenth Annual Report of Ohio Station, 1899 (*Ohio Sta. Rpt. 1899, pp. XXV+387-395, map 1*).—The report contains an announcement relative to the character of the work undertaken at the station, the organization list of the station, a report of the treasurer for the fiscal year ended June 30, 1899, and a report of the director reviewing the different lines of station work and giving a list of acknowledgments. An index to the publications issued during the year and a subject list of station publications are appended.

Annual Report of Virginia Station, 1899 (*Virginia Sta. Rpt. 1899, pp. 14*).—This includes the organization list of the station, summaries of Bulletins 77-88 issued by the station during the year; a financial statement for the fiscal year ended June 30, 1899, and brief outlines of work in horticulture, entomology, mycology, biology, chemistry, veterinary science, and agriculture by the heads of departments.

Report of the agricultural experiment station at Kiel, 1899, A. EMMERLING (*Jahres-Bericht der agrikulturchemischen Versuchsstation in Kiel für 1899. Kiel: Vollbehr & Riepen, 1900, pp. 33*).—This is a summary account of investigations carried out at this institution during 1899, including fertilizer and feeding stuff inspections, miscellaneous analyses, and accounts of cooperative field experiments.

Proceedings of the thirteenth annual convention of the Association of American Agricultural Colleges and Experiment Stations, A. C. TRUE, W. H. BEAL, and H. H. GOODELL (*U. S. Dept. Agr., Office of Experiment Stations Bul. 76, pp. 112*).—This is a detailed account of the proceedings of the convention. For a summary see E. S. R., 11, p. 405.

Organization lists of the agricultural colleges and experiment stations in the United States, with a list of agricultural experiment stations in foreign countries (*U. S. Dept. Agr., Office of Experiment Stations Bul. 74, pp. 121*).—The bulletin contains in addition to the organization lists a subject list of the publications of the experiment stations received by this Office during 1899, Federal legislation affecting agricultural colleges and experiment stations, and the rulings of the Post-Office, Treasury, and Agricultural Departments as to the construction of the act of Congress of March 2, 1887, establishing the stations.

Agricultural education in Austria (*Jour. Bd. Agr. [London], 7 (1900), No. 1, pp. 84-87*).—Outline of the agricultural educational system in Austria.

Cotton-trade schools in the South, J. A. STEWART (*Sci. Amer., 82 (1900), No. 22, p. 342, figs. 7*).—A description of the schools established at Atlanta, Ga., and Clemson College, S. C., for the practical teaching of cotton manufacturing.

Observations and experiments to illustrate the principles of agriculture in elementary schools, W. FAWCETT (*West Indian Bul., 1 (1900), No. 3, pp. 240–259*).

Elementary agricultural education, R. HARPER (*Agr. Gaz. New South Wales, 11 (1900), No. 4, pp. 295–300, figs. 2*).—An account is given of the author's experience in teaching agriculture and horticulture in a public school.

Norway; the agriculture of Norway in relation to the general development of the country, N. A. KRYUKOV (*Norvegiya, selskoe khozyaistvo v Norvegii, v svyazi s obshchim razvitiem strani. St. Petersburg: Russian Ministry of Agriculture and Crown Lands, 1899, pp. 246*).

Agriculture in Bosnia and Herzegovina (*Die Landwirthschaft in Bosnien und der Herzegovina. Sarajero: 1899, pp. 12+397, maps 21, pls. 20, dgms. 14*).—The topographical features of these provinces, their resources, population, crop production, animal production, etc., are discussed. The system of agricultural education adopted and the experiment stations and model farm are described at considerable length.

Australian agriculture (*Mitt. Deut. Landw. Gesell., 15 (1900), Sup. to No. 3, pp. 22, 33*).

Colonial experiment stations, J. DYBOWSKI (*Les jardins d'essai coloniaux. Paris: Hachette & Co., pp. 40, figs. 13*).—Outline of the work of the French tropical colonial agricultural experiment stations, with illustrations and descriptions of some of the more agriculturally important plants of these regions.

Australian experimental farms (*Nature, 61 (1900), No. 1587, p. 528*).—A list of the experimental farms in New South Wales and their principal lines of work.

Explanation of some scientific terms met with in agricultural literature, E. H. GURNEY (*Agr. Gaz. New South Wales, 10 (1899), Nos. 1, pp. 54–63; 2, pp. 171–185; 5, pp. 427–439*).

Manual of a bibliographical repertory of the sciences related to agriculture arranged according to a decimal classification, V. VERMOREL (*Manuel du répertoire bibliographique des sciences agricoles établi d'après la classification décimale. Montpellier: Coulet & Sons; Paris: Ch. Béranger; Paris, Bruxelles, and Zurich: Institut International de Bibliographie, 1900, pp. 239, figs. 2*).

The modern farmer in his business relations, E. F. ADAMS (*San Francisco: N. J. Stone & Co., 1899, pp. 662*).—This is "a study of some of the principles underlying the art of profitable farming and marketing and of the interests of farmers as affected by modern social and economic conditions and forces." The different sections treat of the education of the farmer; the farmer as a business man and as a cooperator; the relations of the farmer to questions of tariff, export bounty, single-tax system, currency, labor questions, referendum, and socialism; and the character, object, and organization of the cooperative fruit-marketing societies of California.

The appendix contains considerable information in small compass concerning the Morrill and Hatch acts, agricultural courses and agricultural extension, books of interest to farmers, statistics relating to banks and to currency, Interstate Commerce Commission rulings, cooperation among farmers and others, etc.

NOTES.

Colorado College and Station.—W. Paddock, of the New York State Station, has been elected to the position of botanist and horticulturist, made vacant by the death of Mr. J. H. Cowen.

Maryland College and Station.—Guy L. Stewart has resigned as assistant in plant pathology to accept a position as assistant industrial agent in charge of the agricultural interests of a prominent railroad line.

New York State Station.—Andrew J. Patten began his duties as assistant chemist of the station August 1, and P. J. Parrot as assistant entomologist August 15.

Oklahoma Station.—A. G. Ford has resigned as assistant chemist of the station in order to pursue graduate work in chemistry at the Pennsylvania State College.

Washington College and Station.—S. W. Fletcher, assistant in horticulture at the New York Cornell Station, has been elected horticulturist.

Wyoming Station.—Luther Foster, of the Utah Station, has been elected professor of agriculture and horticulture.

Personal Mention.—M. G. Kains, special crop culturist of the division of botany of this Department, has resigned to accept the position of horticulturist in the School of Practical Agriculture and Horticulture at Briarcliff Manor, N. Y.

Necrology.—J. Kjeldahl, director of the Carlsberg laboratory, born August 16, 1849, died at Baden July 18, 1900. His best-known contribution to science is the method of determining nitrogen which bears his name.

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EXPERIMENT STATION RECORD.

EDITOR: E. W. ALLEN, PH. D., *Assistant Director.*

EDITORIAL DEPARTMENTS.

Chemistry, Dairy Farming, and Dairying—THE EDITOR and H. W. LAWSON.
Meteorology, Fertilizers and Soils (including methods of analysis), and Agricultural Engineering—W. H. BEAL.
Botany and Diseases of Plants—WALTER H. EVANS, Ph. D.
Foods and Animal Production—C. F. LANGWORTHY, Ph. D.
Field Crops—J. I. SCHULTE.[1]
Entomology and Veterinary Science—E. V. WILCOX, Ph. D.
Horticulture—C. B. SMITH and V. A. CLARK.
With the cooperation of the scientific divisions of the Department and the Abstract Committee of the Association of Official Agricultural Chemists.

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[1] Absent on leave.

BOTANY.

METEOROLOGY.

WATER—SOILS.

FERTILIZERS.

FIELD CROPS.

HORTICULTURE.

FORESTRY.

SEEDS—WEEDS.

LIST OF PUBLICATIONS ABSTRACTED.

EXPERIMENT STATION RECORD.

Vol. XII. No. 3.

The life of the late Sir John Bennet Lawes furnishes a remarkable example of individual zeal and munificence, directed to the promotion of agriculture and the advancement of agricultural science. Born to wealth and luxury, and inheriting an estate upon the management of which he entered with the keenest interest and business sagacity, the squire of Rothamsted early developed a spirit of inquiry which dominated his whole life. A keen observer and an untiring experimenter, he saw in every weed an unsolved problem, in every clod of soil a subject for study. For over 60 years he devoted a large share of time and thought from a busy commercial life to the solution of these problems of agriculture, converting a portion of his estate into an experiment station and providing the means for its maintenance. His thorough knowledge of the details of farming, coupled with his practical sagacity, enabled him to grasp at once the real bearing and importance of each new fact. His services to agriculture are known and recognized throughout the civilized world, but perhaps nowhere have they been more appreciated or had a greater influence than in this country. His name in connection with the famous Rothamsted experiments has for many years been a familiar one in the class room of the agricultural college, at the farmers' institute, and to readers of the agricultural press. The full measure of success which he achieved makes his life one of inspiration and unusual interest. The universal appreciation of his services and the close relations which he has borne to the American stations will cause the deepest regret at his death and a profound sense of loss to the cause of agricultural investigation. He died August 31, 1900, in his eighty-sixth year, "full of days and full of honors, and venerated by all who knew him."

Although Sir John's earlier education, obtained at Eton and Oxford, was mainly classical, he developed a fondness for chemistry which led him to spend some time in London in its study. Some of his earlier work was directed to the isolation of the alkaloids of medicinal plants. He entered upon the management of the paternal estate of Rothamsted at the age of twenty, and some three years later, in 1837, he commenced his experiments with soil in pots. This was before Liebig had

announced his theory of plant nutrition, and when knowledge regarding the requirements of plants and the way in which they secure their nourishment was in very crude state.

His earlier experiments led to the discovery of the value of transforming bone into superphosphate by the use of sulphuric acid. The importance and scope of this discovery was confirmed in more extensive experiments, following which he took out a patent on the process in 1842, and the next year established a fertilizer factory near London. He continued in the management of this business for nearly thirty years, during which time it remained one of the foremost industries of its kind in England. It was sold in 1872 for nearly one and a half million dollars. In 1867 a large factory was acquired for the manufacture of tartaric and citric acids, which his wise business management and ability likewise placed at the head of this branch of chemical manufacture. He continued to operate this factory up to the time of his death.

But the commercial life upon which he entered did not prevent the continuation of the work of investigation which had been undertaken with so much interest, and in 1843 the services of Dr. (now Sir) J. H. Gilbert were engaged to superintend the laboratory investigations. This scientific partnership continued to the close of Sir John's life. His love for the work never waned, and he maintained a close supervision of it. No one knew the experimental fields better than he did.

The development of the station with the flight of years and the extent and character of its investigations are too familiar to need description. With the aid of Dr. Gilbert the field experiments were enlarged and systematized until they occupied nearly 40 acres, the whole of the present series of plats being in operation by 1856. These field experiments have been models of excellence, and in their extent and the systematic regularity with which they have been conducted they are unique. Experiments with animals were taken up in 1847, and since then several hundred oxen, sheep, and pigs have been used in the study of a variety of problems relating to animal nutrition. The work on the composition of animals has become almost classic.

The first paper of Lawes and Gilbert was, as Sir Henry Gilbert once said, "subjected to merciless excision by the editor of the journal to which it was sent," and they secured its publication with difficulty. The collected reports now occupy nine volumes, and have been widely distributed.

The wide recognition of the Rothamsted work which came with time brought its founder many honors. "The Queen created him a baronet in 1882; universities gave him their degrees; societies bestowed upon him their medals. Prosperity could not spoil him. Quite free from personal ambition, he was always ready to give the credit of success to his fellow-workers." This spirit of modesty and generosity

endeared him to all who knew him. It manifested itself in his response at the Rothamsted Jubilee in 1893, which was largely a tribute to his life-long coadjutor. "Had it not been for the constant labors of Dr. Gilbert," he declared, "the affairs of Rothamsted would have been in a different state to that in which they now are."

In 1889 Sir John transferred the laboratories and experimental fields of Rothamsted to a board of trustees with an endowment of nearly a half million dollars, thus making liberal provision for continuing the investigations permanently.

The influence of the Rothamsted station upon agricultural investigation in this country has been very potent and far-reaching. Long before the experiment station movement in the United States its work was widely known and did much to prepare the way for agricultural investigation here. Many a professor of agriculture gained his first inspiration for experimental work from a visit to Rothamsted or from published accounts of the work conducted there.

Three things have contributed to make the influence of the Rothamsted station especially strong in this country. First, it was quite well known, especially among certain classes of readers of agricultural literature, and was regarded by many of them as a model. Being an English station, its literature was more accessible to many and intercourse with the station was quite frequent. Second, much of its work was of a more immediately practical trend and on a basis which appealed to the thoughtful farmer because he could understand its bearing. It enabled farmers to see in what way experiment stations might contribute to the promotion of their interests. It helped to popularize the movement. Finally, the conditions were more nearly similar to our own, our methods of agriculture more nearly approaching those of England, and the experiments had been carried on so long and with such thoroughness as to inspire unusual confidence in them.

Since the establishment of the stations the literature of the Rothamsted work has been at their command. The work and results have been explained in three series of lectures given in this country, and a considerable number of station workers have visited Rothamsted and been privileged to discuss agricultural problems and methods of investigation with its founder. Its influence on the field work of our stations has been very noticeable. The field experiments at Rothamsted are far famed for their excellence and for the systematic way in which they have been conducted. The methods of plat experimentation have there been worked out in all the nicety of detail, and this has saved our stations years of preliminary work on methods.

The Rothamsted field experiments derive their greatest value from the comprehensive plan on which they were laid out, which has enabled their scope to be extended from time to time so as to include new

phases of the questions under investigation as they develop; from the systematic and painstaking manner in which they have been continued through long periods, strengthening the confidence in the results; and from the full notes which have been taken at each stage and placed in permanent form. In some of these respects there is still opportunity for the American experiment stations to profit by the methods at Rothamsted, if field experiments are to continue to form so prominent a feature of their work.

There have been many evidences of Sir John Lawes's deep interest in the American stations. He was in correspondence with some of the leading advocates of the stations before their establishment, and has frequently expressed his admiration of the work which they are doing. Soon after the establishment of the stations Sir John sent twenty-six handsomely bound sets of the Rothamsted publications, prepared at large cost, to be distributed among the stations as far as they would go, and in 1897 he supplemented this gift by a second installment of twenty-six sets, so that practically every station has been provided with a set of these valuable papers. He also distributed about 800 copies of the outline "memoranda" of the Rothamsted investigations among our station workers. His friendly spirit was still further shown by his provision in the Lawes Agricultural Trust for a biennial course of lectures in the United States on the work at Rothamsted. He did this, as he said, in order that Americans should feel that they had a share in any of the benefits which might arise from the Rothamsted endowment.

This fraternity of interest has been helpful to the American stations and a source of much gratification. Rothamsted will continue to be to them an inspiration, and under the generous provision of its founder will undoubtedly maintain the same high position in which he placed it.

INTERNATIONAL CONGRESSES OF HORTICULTURE, VITICULTURE, AND AGRICULTURE AT PARIS.

WALTER H. EVANS, Ph. D.,
Office of Experiment Stations.

Among the congresses held at Paris the past summer in connection with the international exposition, those of horticulture, viticulture, and agriculture are likely to prove of special interest to readers of the Record. The following brief account is prepared from notes taken by the writer and from some of the published proceedings. The doings of the congresses of experiment stations and of agricultural instruction were noted in the preceding number of this journal (pp. 101, 102).

CONGRESS OF HORTICULTURE.

The International Congress of Horticulture was opened by M. Dupuy, minister of agriculture, in the Salle des Congrès, Paris, May 25, and continued three days. Permanent organization was effected with M. Viger president and M. Bergman general secretary, the vice-presidents being selected from the various foreign delegates and distinguished French horticulturists present.

The papers presented covered quite a range of horticultural topics and were discussed at length. The first was a report on progress made in the heating of greenhouses. Steam, it was said, has been employed since 1825, having been used at that time in England. Hot-water heating was advocated as easier of control, and by its use lower constant temperatures are possible than by the use of steam. Public gardens for different regions and the question of the ornamentation of public squares and promenades were discussed. The general principles of ornamentation and requirements for parks, squares, and streets were stated, and the kind of plants adapted to the different conditions indicated. The fourth paper treated of the causes of the clematis disease and its prevention, and led to considerable discussion. Different opinions were expressed as to its cause, some holding it to be due to nematodes, others that it was a question of nutrition. For destroying the nematodes, which are said to be species of Heterodera, the immersion of pots in water for 24 hours was recommended. For open-air culture no means of prevention were proposed. The art of the floral decorator, its development and utility as related to horticulture, was the subject of two contributions. In one the development of the

art was traced from very early times, while the other gave an account of the progress during the nineteenth century. It was shown that at the present time floral decorators in the vicinity of Paris require about $2,000,000 of horticultural products annually.

A report was given on the practical prevention of some diseases of truck crops. One of the largest growers of Roman lettuce near Paris stated that by the use of eau celeste he had entirely overcome the very common loss accompanying the forcing of that crop. Prof. Maxim Cornu recommended the prevention of all similar diseases by spraying the ground at the time of seeding with copper solutions and mulching about the plants with material which had been previously soaked in copper sulphate. Hot-water heating for forcing vegetables was the subject of a paper in which the writer gave results with this system of heating in forcing melons, beans, strawberries, and tomatoes, all of which were profitably grown for the spring market. Carrots, salads, radishes, and cauliflowers did not prove profitable. Considerable difference of opinion was expressed regarding the method of application and composition of fertilizers for truck crops. The advocates of chemical fertilizers and of manures were insistent upon their views. The subject was referred to a subsequent meeting. The rôle of artificial fecundation in horticulture, as shown by some experiments with *Pelargonium zonale*, was the subject of a paper that occasioned considerable discussion. A brief paper was presented on the rôle of electricity in plant growth, in which the author expressed the belief that electricity increased the general vigor of plants. The application of seed selection to the production and fixation of new horticultural varieties was exemplified by two specimens of palms grown from seed from different parts of the parent cluster. Others taking part in the discussion asserted that in improvement of varieties the individual should be the unit of selection, and that repeated experiments tended to throw doubt upon the constancy of differences sometimes noted for seed from different parts of a plant.

Other papers were on the programme but were carried over to the next meeting of the National Horticultural Society of France.

After the adjournment of the congress the delegates and others visited the School of Horticulture and the nurseries and houses of a number of commercial horticulturists at Versailles, the trial farm of Vilmorin, Andrieux & Co., and mushroom caves near Paris.

CONGRESS OF VITICULTURE.

The International Congress of Viticulture was held June 12–16 under the presidency of M. Tisserand, honorary director of agriculture of France. The first session was taken up with reports and discussion on the subject of phylloxera. As means for combating this pest, submersion, the use of carbon bisulphid and potassium sulphocarbonate, and

resistant vines were all discussed, each method having its advocates. The second session was devoted to the consideration of resistant vines; the merits of various varieties and races of American vines as resistant not only to phylloxera but also to drought were pointed out. At the third session the general subject of grape diseases was considered under the guidance of P. Viala, of the Institute National Agronomique. Protection from frost and hail, and problems of vinification were discussed in the fourth session, while the fifth and last session was largely given up to commercial features of the wine industry, the relation of wine and hygiene, and the use of French geographical names of wine regions as trade names by wine producers in foreign countries. This latter practice was severely condemned.

CONGRESS OF AGRICULTURE.

The Sixth International Congress of Agriculture was held July 1–7 under the presidency of M. J. Meline, with M. E. Tisserand vice-president and M. Henry Sagnier general secretary, delegates being present from nearly all the leading nations of the world. The first of this series of congresses was held in Paris in 1889. Subsequent meetings have been held at The Hague, Brussels, Budapest, and Lausanne.

The congress was formally opened by M. Dupuy, minister of agriculture. After a few remarks he introduced the permanent president, who addressed the delegates on the general agricultural situation, contrasting the present conditions with those existing at the time of the first congress. At the conclusion of the address, permanent organization was effected and the congress divided into seven sections with presiding officers as follows: Rural economy, M. Ribot; agricultural education, M. Gomot; agronomy, M. Marquis de Vogüé; zootechny, M. Louis Passy; rural engineering, M. Sébline; tropical and subtropical agriculture, M. Develle; and vegetable pathology, M. E. Prillieux.

In the sections papers were presented and discussed, and in many instances referred back to the general session for further consideration.

In section 1, the causes of the low price of wheat, the rôle of agricultural syndicates in their relation to producer and consumer, and the measures to be adopted to prevent speculators from fixing prices were discussed at length.

Section 2 considered papers on agricultural education in universities, and M. Grosjean, inspector-general of agriculture of France, submitted a report on training schools, professional schools, and special schools of agriculture, horticulture, and viticulture. The discussion on these papers took a wide range, at the conclusion of which a statement was presented embodying the ideas of the section upon the necessities of agricultural education. Where such instruction is not

already given, it is suggested that elementary agriculture be taught in primary schools, or through the establishment of special winter schools or courses. As a means for elementary training these were especially commended. For the higher schools of agriculture, suggestions for their location, equipment, curricula, etc., were made, and it was suggested that the universities direct their courses more toward the application of the various sciences to agriculture.

Papers on the relation between geological formation and agricultural value of soils, the degree to which soil fertility may be determined by chemical analysis, and the utilization of water in agriculture were presented in section 3.

In section 4 the subject of bovine tuberculosis was the principal topic of consideration. Papers were read on its spread, prophylaxis, etc. The sanitary regulations of different countries were reviewed and the necessity of such measures pointed out to those nations not having such laws or regulations.

Section 5 considered papers on the improvement of the sugar beet by selection and cultivation, the use of alcohol in the industries, and the use of molasses and unrefined sugar as feeding stuffs. A number of delegates gave their experiences with sugar and molasses as feeding stuffs, the use of which seems to have been followed with remarkable results.

The sessions of section 6 were in the main given up to the discussion of colonial agriculture, particular attention being given to the conditions for the culture of sugar cane and cotton. It was believed by a number of those taking part in the discussion that the proper conditions for cotton culture would be found in many of the colonies of European countries.

Section 7 received papers on the rust of cereals, diseases of cane, diseases of coffee, the protection of useful birds and animals, etc. At the instance of this section the general session adopted a series of resolutions looking toward the establishment of an international conference committee on plant diseases and their control, the object being to study simultaneously the diseases of various economic plants. A provisional committee was appointed from those in attendance and was directed to organize the international commission and to outline the scope of its work. Those designated for this purpose are: Delacroix, Eriksson, Fischer-Waldheim, Laurent, Prillieux, Sorauer, and Went. To this list there were added by the section: Frank, Marshall-Ward, Wiesner, Rostrup, Galloway, Linhart, Targioni-Tozzetti, Cuboni, Jaczewski, Fischer, and Chodat. It was also determined to publish a periodical bulletin giving the practical results of the studies of the commission.

Among the subjects suggested for investigation by this commission is cereal rusts. It was recommended that the various nations where

cereal rusts abound authorize and encourage the study of these diseases and means for their prevention for at least five years, this study to include the investigation and breeding of resistant varieties to take the place of those now cultivated. On account of the danger of the spread of diseases of coffee, cacao, and sugar cane to countries not now affected, it was suggested that the importation of all living stocks be under strict governmental control and such exchanges be isolated for a year or more until all danger of infection is past. Attention was called to the necessity of recognizing the relation between low vitality of plants and their liability to disease, and of taking steps toward studying the proper hygiene of the plant.

On July 3 the subjects of agricultural education and the protection of useful birds and animals were considered in general session, having been referred to the general congress from their respective sessions. Consideration was also given the reports on the improvement of sugar beets, and from section 7 on plant diseases. In the afternoon the delegates visited the sewage works at Achères, where the sewage of Paris is disposed of. The filtration works have a superficial area of over 9,000 acres.

The general sessions of the congress on July 4 were taken up with reports on the improvement of races of stock, and on the question of wheat supply and demand, both topics being discussed at considerable length.

July 5 was given up to excursions to Verrières, the trial grounds of Vilmorin, Andrieux & Co., and to the farm of M. Henry Petit. This latter has been maintained as a model farm in this family since 1740.

At the general session of July 6 the subject of import and octroi duties as bearing on the price of agricultural produce was discussed, and reports received from the different sections. The afternoon session was given up to reports on agricultural insurance, cooperative bakers, use of alcohol in various industries, molasses for distilleries, agricultural syndicates, and agricultural cooperative associations.

At the morning session of July 7 in section 3 a report was made on the reclamation and bringing under cultivation of certain tracts of land near the sea. More liberal concessions on the part of the Government are required to make such enterprises successful in France at least. A paper on irrigation in France was read and discussed. It was stated that of between 6 and 7 million hectares of land capable of irrigation but 250,000 hectares have been improved in this way. The subject of mountain pastures and pasturage as bearing upon the question of reclamation of such regions was introduced and considered at some length. On account of the importance of the topic it was formally referred to the next meeting of the congress, two years hence, at which time reports are to be expected from all the nations taking part in the congress.

In section 4 the relation of the Government to horse breeding was discussed. The improvement of horses in France is largely effected through sires owned by the Government. The effect of mechanical means of locomotion as relating to horse raising was considered. The advent of automobiles is said to threaten the demand for medium and low grade horses, but for the higher-priced animals no fear was expressed.

Other section reports were presented, among them the suggestions for agricultural education in primary schools, and agricultural schools for women. In primary schools giving agricultural instruction, it was agreed that they should confine their efforts to a knowledge of the common rocks and soils of the region and elementary knowledge concerning the minerals contained, also the use of fertilizers, recognition of plants, seeds, insects, etc. The instruction in these lines should be supplemented with visits to some of the better farms in the neighborhood of the school, where various agricultural operations could be observed. The necessity and desire for dairy schools and schools of domestic economy for women were pointed out, and those countries possessing such institutions were commended. Traveling dairies and similar institutions received the sanction of the congress as beneficial. The control of fertilizers, foods, etc., in the interest of agriculture and for the repression of fraud was discussed and the desirability for a unification of methods of analysis and repressive measures was pointed out. The rôle of fields of demonstration and experiment as factors in advancing agriculture was shown and the more frequent establishment of such fields advocated. Reports were submitted on experiment stations, seed-testing stations, practical schools of agriculture, schools for the study of colonial agriculture, combating fungus and insect pests, mulberry culture, etc.

On July 7 the President of France gave a reception to the officers and delegates of the congress. After the reception a banquet was given at the Hotel Continental, which was largely attended by the members. Rome was selected as the place of the next meeting, which will be held in 1902.

At the close of the congress excursions were taken to the experiment station and national agricultural school at Grignon, School of Horticulture at Versailles, to the north of France, Douai, Lille, etc., where numerous model farms, distilleries, dairy and stock farms, vineyards, etc., were visited.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

Determination of phosphoric acid available as plant food in soils and fertilizers, J. PLOT (*Oesterr. Chem. Ztg., 3 (1900), pp. 127–131; abs. in Jour. Chem. Soc. [London], 78 (1900), No. 453, II, p. 510; Jour. Soc. Chem. Ind., 19 (1900), No. 7, p. 675*). The solvent used by the author is claimed to resemble closely beet juice in respect to salts, and is prepared as follows: Dissolve 0.4004 gm. of ferrous sulphate, 1.4616 gm. of potassium sulphate, 3.7098 gm. of calcium nitrate, and 2.890 gm. of magnesium chlorid in 1 liter of water. Fuse 7.0566 gm. of crystallized sodium carbonate, 6.744 gm. of potassium carbonate, and 0.2 gm. of silicic acid in a platinum crucible, dissolve the fused mass in water and mix with 2.75 gm. of oxalic acid, 1.9840 gm. of malic acid, 2.2994 gm. of citric acid, 1.9396 gm. of tartaric acid, and then dilute to 1 liter. For use, these two solutions are mixed in equal parts; 25 gm. of air-dried soil, or 5 gm. of a fertilizer, are shaken for half an hour in a half liter flask with 500 cc. of the liquid. Phosphoric acid is determined in 200 cc. of the filtered extract thus obtained.

Determination of cane sugar in condensed milk, L. GRÜNHUT and S. H. RIIBER (*Ztschr. Analyt. Chem., 39 (1900), No. 1, pp. 19–36*). The authors report a critical examination of the various methods employed in the estimation of cane sugar in the presence of milk sugar. In the analysis of condensed milk they consider inversion by hydrochloric acid of the highest importance when methods of reduction with Fehling solution, before and after inversion, are used. If the quantity of cane sugar in a sample is to be drawn from the reducing power after inversion, the reduction before and after inversion must be made under exactly the same conditions, as concentration of solution and length of heating materially influence the quantity of cuprous oxid deposited. The gravimetric methods of Ost and Kjeldahl are the only two known to the authors that fulfill this condition, and the Ost method has been proven both by Ost himself and by Schmöger to be practically valueless for determining milk sugar, leaving only the Kjeldahl method.

G. Bruhns has shown that a considerable error results from a slight decomposition of cane sugar by boiling 20 minutes with a very strong

Fehling solution, as directed in the Kjeldahl method. This error is due to the reducing power of decomposition products. Again, in the analysis of condensed milk by the reduction methods, the percentages of milk sugar will be entirely too high in consequence of the excessive deposition of cuprous oxid. These errors render necessary an empirical table of corrections for each absolute and relative amount of both sugars present. Moreover, it is incorrect, the authors claim, to calculate the amount of cane sugar from the difference of copper reduced by milk sugar before inversion and that reduced by milk and invert sugars after inversion, as the products of reduction of the two sugars cause simultaneous reduction that can not be added directly. They conclude, therefore, that it is impossible to determine accurately cane sugar in condensed milk by the reduction methods.

To obtain correct results by using the methods based on polarization before and after inversion and applying the formula of Clerget in the estimation of cane sugar, the authors had to adopt many safeguards.

It is claimed that the complex rotatory influence of milk sugar is rectified by treatment of condensed milk with boiling water and then cooling. The authors did not find that the specific rotatory power of cane-sugar solutions was materially changed by heating to 100° C., as did Richmond and Boseley.

In correcting for volume of casein and fat precipitated, the double dilution method was employed.

The authors' results were calculated by Clerget's formula as modified by Herzfeld. In correcting volume they object to using the official factor 0.962, as it is asserted to be applicable only to substances of a particular chemical composition. C. B. WILLIAMS.

The adulteration of cane-sugar sirup with glucose, H. D. RICHMOND (*British Food Jour., 2 (1900), No. 19, p. 178*). Glucose is used extensively in the sophistication of saccharine foods, especially golden sirup, to prevent, as the manufacturers claim, granulation caused by the crystallization of a portion of the cane sugar. The real reason, the author states, is to make more salable unpalatable sirup of good color which is obtained as a by-product in the refining of sugar. The saline taste of the crude refinery sirup is obscured by the addition of large quantities of cheap and comparatively tasteless glucose. This sirup, lacking sweetness, is consumed in much greater amounts than golden sirup, and its high content of potassium salts is thought to be liable to injure the consumer. If prevention of granulation were the sole object for the addition of glucose to golden sirup, then 5 per cent would be sufficient; but as much as 70 or 80 per cent has often been found incorporated. C. B. WILLIAMS.

On the determination of the acidity of milk, M. SIEGFELD (*Molk. Ztg., 14 (1900), No. 13, pp. 205-207*). The results of experiments were rather unfavorable to the use of solutions of calcium hydrate pre-

pared from commercial lime for the volumetric determination of the acidity of milk in ordinary dairy practice. Comparative tests were made of decinormal solutions of sodium hydrate, potassium hydrate, and barium hydrate for determining the acidity of milk. The results showed that from 1.4 to 2.6 cc. more of the decinormal barium hydrate was required to neutralize 50 cc. of milk than was required of either of the other standard solutions. Phenolphthalein in varying quantities was used as an indicator. Fourth, tenth, and twentieth normal solutions of sodium hydrate were compared. The weaker solutions gave a lower average percentage of acid. Milk was diluted with different quantities of water and alcohol, and the acid content determined. The percentage of acid was apparently lessened by the addition of water and increased by the addition of alcohol. Determinations showed no material difference in the acidity of milk at temperatures varying from 5 to 60° C. The acid content was slightly lower at higher temperatures. The reaction of the reagents used with the phosphates in the milk is discussed as explaining some of the varying results obtained. The author concludes that the dilution of milk in the determination of acidity is to be avoided and that sodium hydrate and potassium hydrate are preferable to barium hydrate, and may be used as well in tenth as fourth normal solutions.

A new indicator, J. FORMÁNEK (*Ztschr. Analyt. Chem., 39 (1900), No. 2, pp. 99–103*). An alcoholic solution of alizarin green B gives a carmine-red color with acids and green with alkalis. It is sensitive to carbonic acid. The color changes are very sharp, and the indicator can be used in artificial light as satisfactorily as in daylight.—C. B. WILLIAMS.

Report of the chemists, W. R. PERKINS and E. B. FERRIS (*Mississippi Sta. Rpt. 1899, pp. 31–41*).—This report gives analyses of soils from different parts of the State (see p. 222); of manure from animals fed cotton seed and cotton-seed meal, sorghum, and forage plants (E. S. R., 11, p. 1022); and artesian well waters (see p. 222); and describes briefly pot and field experiments on soils in progress at the station.

Reports of the chemical stations in Sweden for 1898 (*Meddel. K. Landtbr. Styr., 1900, No. 63, pp. 367–400*).—The 8 regular chemical stations maintained in part by the Swedish Government examined during the year 54,067 different samples of agricultural products, of which number 44,599 samples were milk and other dairy products, 1,031 fertilizers, 793 soil samples, etc. The average results of the examinations, with brief discussions of the same, are given in the report.—F. W. WOLL.

On testing food products for boric acid and borates with turmeric paper, E. H. JENKINS and A. W. OGDEN (*Connecticut State Sta. Rpt. 1899, pt. 2, pp. 153–155*).—The authors found testing with turmeric paper much more satisfactory than the flame test. A study was made of the method of making the test. The following precautions are given:

"Free boric acid can not readily be identified by the turmeric-paper test if borates are present.

"The material to be tested must in all cases be acidified with hydrochloric acid in order to ensure a satisfactory reaction with turmeric paper.

"A considerable excess of hydrochloric acid must be added to the solution to be tested—one-thirtieth by volume of concentrated HCl is not too much.

"Perfectly decisive reactions need not be expected where less than one part of boric acid is present in 10,000 of water."

Detection of boric acid or borates, H. BORNTRÄGER (*Ztschr. Analyt. Chem., 39 (1900), No. 2, p. 92*).

The separation and determination of formic, acetic, propionic, and butyric acids by Haberland's method, J. SCHUTZ (*Ztschr. Analyt. Chem., 39 (1900), No. 1, pp. 17, 18*).

Boemer's method of detecting cotton-seed oil in lard, M. WEIBULL (*Meddel. K. Landtbr. Styr., 1899, No. 59, pp. 33–42*).

On the chemical determination of the nutritive value of fodder beets, L. HELWEG (*Tidsskr. Landbr. Planteavl, 5 (1899), pp. 178–189*).—Discusses errors of sampling and analysis of beets.

On the presence of dextrose and levulose in the leaves of beets, L. LINDET (*Ann. Agron., 26 (1900), No. 2, pp. 103–113*).

On the presence of mannocellulose in the ligneous tissue of gymnosperms, G. BERTRAND (*Compt. Rend. Acad. Sci. Paris, 129 (1899), No. 24, pp. 1025–1029*).

The furfuroids of plant tissues, C. F. CROSS, E. J. BEVAN, and J. S. REMINGTON (*Jour. Soc. Chem. Ind., 19 (1900), No. 4, pp. 307–310*).

Systematic analysis of glucose, S. STEIN (*Internat. Sugar Jour., 2 (1900), No. 20, pp. 405–412*).

Some chemical notes on the composition of the cocoanut, J. E. KIRKWOOD and W. J. GIES (*Science, n. ser., 11 (1900), No. 285, p. 951*).

Analyses of borax, A. W. OGDEN (*Connecticut State Sta. Rpt. 1899, pt. 2, pp. 150–153*).—The analysis of a number of samples of borax is reported.

Analyses of formaldehyde or formalin, A. W. OGDEN (*Connecticut State Sta. Rpt. 1899, pt. 2, p. 156*).—Tabulated analyses are given of 4 samples of formalin. The percentage of formaldehyde ranged from 36.02 to 42.30.

Examination of foods, condiments, and commercial products, G. RUPP (*Die Untersuchung von Nahrungsmitteln, Genussmitteln und Gebrauchsgegenständen. Heidelberg: Carl Winter's Universitäts-Buchhandlung, 1900; 2 ed., ill.*)

Examination of the most important foods and condiments, C. BEIER (*Die Untersuchung unserer wichtigsten Nahrungs- und Genussmittel. Leipsic: C. G. Naumann, pp. VIII+147; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 3 (1900), No. 4, p. 298*).—This work forms Nos. 116 to 118 of the series entitled "Medicinischen Bibliothek für praktische Aerzte."

Miscellaneous analyses, E. F. LADD (*North Dakota Sta. Rpt. 1899, pp. 13, 14*).—Analyses are reported of coal from western North Dakota, ashes from lignite, and clays (9 samples) from different parts of the State.

BOTANY.

Studies of the time and rate of development of the potato tuber, L. R. JONES and W. A. ORTON (*Vermont Sta. Rpt. 1899, pp. 155, 156*). Previous investigations on this subject (E. S. R., 5, p. 988) have been repeated, using 75 rows of potatoes. All were planted at the same time on rather heavy clay soil, were sprayed with Paris green in the early part of the summer, and received 3 applications of the Bordeaux mixture in the latter part, so that the vines were in a fairly healthy condition quite late in the season. Beginning August

4, every ninth row was dug at intervals of 10 days. The total yield of tubers and yield of marketable size is given, showing that a considerable portion of the yield of marketable tubers was formed after September 1. The unsprayed vines in this experiment were nearly all dead before August 20. The results of this experiment lead the authors to repeat the former statement that "the potato crop of Vermont suffers far more each year than is generally realized from the premature death of the vines."

Development of the buds of the wild plum, L. R. WALDRON (*North Dakota Sta. Rpt. 1899, pp. 31-39, figs. 6*).—Investigations have been made on the time and manner of differentiation of leaf and flower buds, and the influence affecting the formation of flower buds; also a study of the reserve materials of the plant.

The present report is in the nature of a preliminary one, some phases of the work being still under investigation. Among some of the more important deductions drawn from the investigations, the author states that the stamens, pistils, and bud scales must be considered as modified portions of the tissues of the shoot axis and not as modified foliage leaves. In the plant investigated the number of flowers starting in a bud is 4, which may often be lessened by some being killed. Lignin is formed early in the life of the bud, and by September the lignified portion is sharply differentiated from the cellulose portion. The organic parts of the flower are formed before winter, the ovule in the spring. The most important time of differentiation of leaf and flower buds appears to be from the middle of July to the middle of August, although there is some evidence to show that it may take place later.

The effect of centrifugal force upon the cell, D. M. MOTTIER (*Ann. Bot., 13 (1899), No. 51, pp. 325–361, pl. 1*).—The author has undertaken to determine what parts of the living substance and its inclusions could be displaced within the cell by means of centrifugal force several hundred times greater than that of gravity, acting for a definite but usually short period of time, and to see what effect such displacement might have upon the individual cell.

Various algæ, leaves of mosses, trichomes of a number of plants, staminal hairs from Tradescantia, leaves of a number of plants, and seedlings of maize, beans, castor beans, and horse beans were used in the experiments. The centrifugal force was generated by the use of an ordinary milk separator driven by a gas motor. After subjecting the plants to this force for a number of hours it was found in the case of the algæ and mosses that the chlorophyll in the cells was all forced toward the distal end. This was also true of the contents of the cells of most of the other plants experimented with. After standing a time the normal condition of the distribution of the cell contents was resumed, at first rapidly but later very slowly.

The experiments with the seedlings of the plants mentioned were

largely conducted to determine the effect of centrifugal force on the nucleus. The results obtained bear directly upon the specific gravity of the various cell constituents, and especially those of the nucleus. It is stated that there can be no doubt that the nucleolus is relatively a very heavy body and that its specific weight is greater in the nuclei of cells destined to great constructive activity.

The destruction of chlorophyll by oxidizing enzyms, A. F. WOODS (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 22, pp. 745–754*).—The author reports on a series of studies made on the relation which exists between oxidizing enzyms and decoloration of leaves. Oxidizing enzyms, both oxidase and peroxidase, were found plentiful, and some of their characteristics are described, together with notes on their presence and effect on variegated maple, horse-chestnut, and a number of other plants. A careful comparative investigation showed that the intensity of the power of oxidase was inversely proportional to the amount of chlorophyll present, as judged by color. The peroxidase follows the same rule.

The principal portion of the investigation was conducted with tobacco, in which the so-called blanching or mosaic disease was examined with particular care. Peroxidase was always found in greater quantity and twice as strong in the light-colored areas as in the green ones, and where the chlorophyll had nearly disappeared, leaving albino spots, the oxidase was twice as abundant as in the green of the same leaf or the green of healthy leaves. The author claims that there is no good reason for separating this disease of tobacco from true variegation or albinism. He has been able to produce it at will, and as yet no organism has been isolated that proved to be the cause of variegation.

The conclusions of the author are that chlorophyll is rapidly destroyed by the oxidizing enzyms, oxidase, and peroxidase. These enzyms are normally present in small quantity in many of the higher plants, and under certain conditions either become more active or are produced in greater quantity, resulting in variegations and other forms of disease. The active agents in producing the mosaic disease of tobacco appear to be enzyms rather than the "living fluid contagion" suggested by Beijerinck (E. S. R., 11, p. 167). The mosaic disease may be produced at will, and the enzyms can remain in the soil uninjured for several months. In aqueous solutions the oxidases are destroyed by 5 minutes' exposure to temperatures of 65 to 70° C., and the peroxidases by 5 minutes' exposure to temperatures of 80 to 85° C.

On the formation of proteids during the germination of wheat in darkness, J. GOLDBERG (*Rev. Gén. Bot., 11 (1899), No. 129, pp. 337–340, fig. 1*).—A considerable number of grains of wheat were germinated in the dark, at temperatures ranging from 20 to 22.5°. At intervals of 3, 8, and 14 days the author removed 60 of the plantlets

of equal development, separated the embryo from the endosperm, and determined the protein and nitrogen according to the methods of Stutzer and Vigeldatl. The results of the analyses are shown, from which the author claims that proteids are formed in considerable quantity by the embryos of wheat during the process of germination. It is further claimed that this increase could not have come from the endosperms by osmosis, but was formed in the embryo.

Concerning the physiological functions of solanin, G. ALBO (*Contrib. Biol. Veg., 2 (1899), No. 3; abs. in Ann. Agron., 25 (1899), No. 12, pp. 621, 622*).—Solanin has been previously regarded by different authors as a means of defense and as a transfer form of albumin similar to asparagin. The author studied the question by examining micro-chemically a number of species of Solanum grown under normal conditions, in shade and in an atmosphere lacking in carbon dioxid.

Solanin was found in the stems, leaves, tubers, and seeds of most species of Solanum grown under normal conditions. During and following germination it diminishes, but reappears with the development of the plant and is abundant in the adult plant. When grown in darkness, solanin gradually disappears, and negative reactions were obtained for a considerable time before the death of the plant. If the seeds of *Solanum sodomeum* are germinated in the dark, there is a complete disappearance of the alkaloid. When the seedlings were brought into the light, the solanin reappeared soon after the chlorophyll functions were established. The same is true of the seeds of the eggplant, tomato, potato, and numerous species of Capsicum.

From the results of these experiments the author believes that solanin can not be considered a transfer form of the albuminoids, but is a true nitrogenous reserve material used by the plant during its first stages of development. On this account it is claimed that solanin can not be considered simply as a means of defense on the part of the plant against animals.

The inhibiting action of oxidases upon diastase, A. F. WOODS (*Science, n. ser., 11 (1900), No. 262, pp. 17-19*).—While engaged in a study of the mosaic disease of tobacco leaf, the author found that the lighter-colored areas contained more starch in the form of granules than the green areas of the same leaf. He has pointed out elsewhere (see p. 216) that these light-colored cells exhibit much more oxidizing activity than the green cells of the same leaf. In all examples there was a greater amount of oxidizing enzyms, oxidases as well as peroxidases, in the light-colored tissues. Mainly upon this evidence the author considered the light-colored tissues as the diseased portions of the leaves.

Recent histological studies of diseased leaves reveal important differences, which make it very clear that the light-colored areas are not normal. In badly diseased leaves the palisade parenchyma is not

developed at all in the light-colored areas. In leaves severely attacked by the disease, by simply looking across the leaf depressions may be observed where the light areas occur. The cells of the diseased areas translocate their starch with great difficulty and often become completely gorged.

The conclusion seems warranted that the tardiness in translocation of starch in the diseased area is due to the abnormal activity of the oxidizing enzyms in these cells, by reducing or weakening the activity of diastases.

The inoculation of soil, G. W. HERRICK (*Mississippi Sta. Rpt. 1899, pp. 42, 43*).—In the autumn of 1898, 3 plats of vetch were sown to note the effect of inoculation of the soil on this crop. The first plat was inoculated by soaking the seeds in water in which had been stirred soil from a field in which vetches had been previously cultivated. After being thoroughly wetted, the seeds were sown in drills and covered. Plat 2 was retained as a check plat, while plat 3 was inoculated by scattering dry dirt from the vetch field in the drills as the seed were sown.

The following May the plats were cut and carefully weighed, and it was found that plat 1 yielded 64.5 lbs.; plat 2, 48 lbs.; and plat 3, 79 lbs. of green forage. Pot experiments with vetch were attempted, but the results obtained were contradictory. Plats of crimson clover and alfalfa were sown and treated in the same manner as described for the vetches, but negative results were obtained on account of the non-germination and poor stand of the plants.

Annual report of the consulting botanist for 1899, W. CARRUTHERS (*Jour. Roy. Agr. Soc. England, 3. ser., 10 (1899), pt. 4, pp. 678–688, figs. 13*).—Among the items reported upon by the consulting botanist are investigations on the germination of seeds, weeds, and diseases of plants. During the year the seeds examined were remarkably free from impurities and the germinations high, although in some cases there was considerable fluctuation.

On account of injury to stock, investigations were made with a number of plants which are either poisonous or represented to be, and a list of those mentioned include *Ranunculus acris*, *R. parviflorus*, *R. ficaria*, Celadine, *Arum maculatum*, laurels, *Nicotiana affinis*, *Heracleum sphondylium*, *Prunella vulgaris*, and *Nepeta glechoma*. A number of other plants are mentioned which were suspected of being injurious to stock, but which the author doubts having any noxious qualities.

Among the diseases reported upon were 2 diseases of wheat, one due to *Cladosporium herbarum*, the other to the mildew, *Erysiphe graminis*. A field of peas badly infested with *Pythium debaryanum* is reported upon, and *Ascochyta pisi* has proved troublesome on bean crops in a number of places. Attacks of *Plasmodiophora brassicæ* are

noted from two localities. Leaves of pear trees were identified by the author as affected by species of Sphæria, the trees in this instance having nearly every leaf attacked.

A report is given on impurities found in a number of feeding stuffs, and a brief account of an investigation in which the effect of lightning on a number of trees is shown.

Saltbushes (*Queensland Agr. Jour., 6 (1900), No. 4, pp. 254–257, pls. 3*).—Notes are given on a number of species of Atriplex, their habits of growth and possible value being described. Extensive quotations are given from California Station Bulletin 125 (E. S. R., 11, p. 636).

Botanical notes on wheat and spelt, A. S. HITCHCOCK (*Amer. Gard., 21 (1900), No. 295, pp. 556, 557*).—Notes the classification of the different kinds of wheat according to the recognized species. *Triticum monococcum, T. polonicum*, and *T. sativum*. The latter is divided into *T. spelta, T. dicoccum, T. turgidum, T. durum, T. compactum*, and *T. vulgare*.

The North American species of Chætochloa, F. LAMSON-SCRIBNER and E. D. MERRILL (*U. S. Dept. Agr., Division of Agrostology Bul. 21, pp. 44, figs. 24*).—This bulletin contains a revision and enumeration of the North American species of Chætochloa, commonly known as Setaria. According to the authors, 28 species are found in the region covered by the bulletin, 23 of which are native of North America, the others having been introduced from Europe. Six of the species are here published for the first time.

Botanical origin of caoutchouc and gutta-percha, P. GRÉLOT (*Origine botanique des caoutchouc et gutta-percha. Paris: Berger-Levrault & Co., 1899, pp. 276, figs. 7*).—Descriptions are given of the plants producing caoutchouc and gutta-percha, with historical notes, chapters on methods of culture and handling, commercial movement, properties, composition, etc.

Poisonous plants, F. M. BAILEY (*Queensland Agr. Jour., 6 (1900), No. 5, pp. 382, 383, pl. 1*).—Descriptive notes are given of the physic nut (*Jatropha curcas*).

The nutation of Helianthus, J. H. SCHAFFNER (*Bot. Gaz., 29 (1900), No. 3, pp. 197–200, figs. 10*).—The nutation of wild and cultivated sunflowers is figured and described.

Can strontium and barium replace calcium in phenogams? U. SUZUKI (*Bul. Col. Agr. Imp. Univ. Tokyo, 4 (1900), No. 1, pp. 69–79, pl. 1*).—The author has investigated the possibility of substituting strontium and barium for calcium in the growth of plants, experiments being made in sand and water cultures. The results obtained indicate that these substances not only can not replace calcium but they are strongly poisonous to the plants. This poisonous action may to a certain degree be lessened by the addition of lime salts.

The nutrition of humus plants, R. Y. LEAVITT (*Amer. Gard., 21 (1900), No. 295, pp. 552, 553, figs. 3*).—The nutrition of the Cupuliferæ, Betulaceæ, Ericaceæ, and Coniferæ by means of mycorrhiza is explained.

Some wood-destroying fungi, G. F. ATKINSON (*Geol. Survey Louisiana, 1899, pp. 331–338, pls. 7*).—Notes are given on *Polyporus borealis, Hydnum septentrionale, Fomes fomentarius, Trametes pini*, and *Dædalea ambigua*.

The haustoria of the Erysipheæ, G. SMITH (*Bot. Gaz., 29 (1900), No. 3, pp. 153–184, pls. 2*).—The structure and behavior of the haustoria of the powdery mildews, as shown by the author's investigations of a dozen species representing different genera, are described. Hitherto the minute structure and development of these organs seems to have been almost wholly unknown.

Nitrogen and Nitragin, L. C. NEWELL (*Pop. Sci. Mo., 54 (1900), No. 9, p. 164*).—Popular notes.

Inoculation experiments with Nitragin, J. Käppeli (*Jahresber. Landw. Schule Rütti, 1898–99, pp. 68–70*).—A brief account is given of inoculation experiments with Nitragin on peas, vetches, and lupines in which average gains are reported of 4.3, 6.8, and 10.5 per cent, respectively.

Our botanic gardens, P. MacMahon (*Queensland Agr. Jour., 6 (1900), No. 4, pp. 288–292, pl. 1*).—Brief notes are given on 149 species of plants, mostly timber trees, the seeds of which are offered in exchange.

Report of the Natal Botanic Gardens, J. M. Wood (*Durban, 1899, pp. 14*).—In addition to the routine report of the gardens and herbarium, economic notes are given upon a number of plants that are thought to be of value for that region.

METEOROLOGY.

Report of the meteorologist, J. E. Ostrander (*Massachusetts Hatch Sta. Rpt. 1899, pp. 74–95*).—A brief statement of the work of the year in this department of the station and monthly summaries of observations at Amherst, Mass., on pressure (maximum, minimum, mean, and range), temperature (maximum, minimum, and mean), dewpoint, relative humidity, cloudiness, sunshine, precipitation, wind movement, velocity, and pressure, snow, frost, etc., for 10 years (1889–1898), with normals and a general summary for the period. The following data are taken from the general summary:

Pressure (inches).—Maximum, 30.65, February 26, 1889; minimum, 28.24, February 8, 1895; mean, 30.029. *Air temperature* (degrees F.).—Maximum, 98, July 20, 1894; minimum, —19, February 3, 1898; mean, 47.1; mean annual range, 107; mean daily range, 22.1. *Humidity.*—Mean dewpoint, 40.2; mean relative humidity, 73.5. *Precipitation.*—Greatest annual, 1897, 57.05 in.; least annual, 1894, 32.64 in.; mean annual, 46 in. *Wind.*—Mean annual movement, 51,566 miles; maximum pressure per square foot, 43 lbs., September 11, 1895. *Weather.*—Mean cloudiness observed, 52.4 per cent; total cloudiness recorded by the sun thermometer, 22,400 hours, or 50.3 per cent; number of cloudy days, 1,444. *Bright sunshine.*—Number of hours recorded, 22,120, or 49.7 per cent.

Appendix to report of meteorologist, R. E. Trimble (*Colorado Sta. Rpt. 1899, pp. 96–104, 110–112, charts 2*).—Tables give monthly and annual summaries of observations during 1898 and 1899 on temperature, humidity, precipitation, snowfall, dewpoint, days of frost or dew, cloudy and stormy days, and direction of the wind at Fort Collins, Rockyford, and Cheyenne Wells, and on temperature, precipitation, snowfall, and stormy days at Estes Park (at base of Longs Peak, elevation 9,000 ft.), Pinkhampton (elevation 8,400 ft.), and Gleneyre (elevation 8,000 ft.). The monthly and annual rainfall at Fort Collins (1872–1899) and at 7 additional places in the watershed of the Cache la Poudre River is also reported. Observations during 13 years (1887–1899) on the evaporation from a water surface are tabulated.

Meteorological summary, J. S. Moore (*Mississippi Sta. Rpt. 1899, pp. 45–47*).—Tables are given which show the daily and monthly precipitation with departures from normal, monthly temperatures with departures from normal, cloudiness, and direction of the wind for the year ended June 30, 1899. The most remarkable feature of the weather during this period was the extreme low temperatures of February 11–14, 1899, during which the temperature fell to −8° F., and the continued cold and wet weather of March and April.

Summary of temperature, rainfall, and sunshine, E. F. Ladd (*North Dakota Sta. Rpt. 1899, p. 14*).—Tables give the maxima, minima, and mean temperatures for each month of 1899; also the total rainfall, monthly and yearly, for 1899 and 7 preceding years, and the hours of sunshine. The rainfall during 1899 was 21.21 in.; the mean annual rainfall for 8 years (1892–1899) was 19.87 in.

Sunshine records at Aas Agricultural College, J. Sebelien (*Norsk Landmandsblad, 19 (1900), No. 10, pp. 109, 110*).—The author has made daily records of the amount of sunshine at the State Agricultural College of Norway (latitude about 59.5 deg. N.) during the past three years by the photographic method. The total amount of sunshine for the year 1897 was 1,700 hours, or 38.9 per cent of the number of hours during which the sun was above the horizon; in 1898 the amount was 1,632 hours 29 minutes (36.5 per cent of theoretical maximum), and in 1899, 2,197 hours 18 minutes (49.2 per cent of theoretical maximum). In midsummer the sun sets at about 10 p. m. at Aas, but owing to the small amounts of photographically active rays in the sunshine when the sun is near the horizon it was only possible to register sunlight a few times after 9 p. m. during 1898, and in 1899 no records were made after this time, the records as a general rule closing at about 8.15 p. m.—F. W. WOLL.

WATER—SOILS.

Nature, value, and utilization of alkali lands, E. W. Hilgard (*California Sta. Bul. 128, pp. 46, figs. 16*).—This is a general summary of the results of investigations at the California Station on this subject during the past 20 years, the details of which have been published in reports and bulletins of the station. The topics treated include occurrence and characteristics of alkali soils, how plants are injured by alkali, effects of irrigation, distribution of alkali salts in the soil, composition of alkali salts, utilization and reclamation of alkali lands, removing the salts from the soil, crops suitable for alkali lands, amount of salts compatible with ordinary crops, limits of saline content of waters used for irrigation, and reclaimable and irreclaimable alkali lands as distinguished by their natural vegetation.

The geology of Louisiana, G. D. Harris and A. C. Veatch (*Louisiana Stas. Spec. Rpt. Geol. and Agr., pt. 5, pp. 354, pls. 53, figs. 3, maps 12*).—This report summarizes previous work on the geological and agricultural survey of Louisiana (E. S. R., 10, p. 330) and gives an account of additional investigations on the same subject. The report is divided into three parts. The first is a historical review of investigations from the earliest times up to and including those of the Louisiana Experiment Stations. The second part deals with the general geology of the State, including stratigraphic geology and economic geology. Under the latter head are reported the results of observations on the occurrence, extent, and quality of the deposits of salt, sulphur, clay, sandstone, limestone, and gravel, which are classed as important products, and of the following unimportant products: Iron ores, lignite, lead and zinc ores, marl, gypsum, petroleum, and gas. The third part contains reports of investigations in special lines, including (1) the Natchitoches area, (2) the Shreveport area, (3) the Five Islands, (4) a report on Louisiana clay samples (by H. Ries), (5) a report on a collection of fossil plants from northwestern Louisiana (by A. Hollick), (6) the cretaceous and lower eocene faunas of Louisiana, (7) establishment of meridian lines, (8) a few notes on roadmaking, and (9) some wood-destroying fungi (by G. F. Atkinson, see p. 219). The

first of these reports deals with the topography, stratigraphy, soils, and springs of the area studied; the second with topography and drainage, the great raft in the Red River and its effects, the geology and soils of the bottoms, the geology of the hill lands, and aboriginal works on Caddo bottoms, etc. The notes on soils relate rather to "their general aspect and location than to their agricultural value." Discussion of the latter is deferred until analyses of the soils have been completed. The typical soil areas are mapped. The third report gives a history of the study of the Five Islands and the geographical position and a general topographical description of the islands, special attention being given to the occurrence, origin, and extent of the salt deposits and the history of their exploitation.

Analyses of artesian well waters, W. R. PERKINS and E. B. FERRIS (*Mississippi Sta. Rpt. 1899, p. 41*).—The mineral constituents of 6 samples of artesian well water are reported.

Drinking water, C. H. JONES and B. O. WHITE (*Vermont Sta. Rpt. 1899, pp. 145, 146*).—Examinations with reference to sanitary condition of 4 samples of spring water, 12 of well water, and 2 of brook water are reported.

Distilled water for drinking purposes, H. L. BOLLEY (*North Dakota Sta. Rpt. 1899, pp. 29–31, figs. 2*).—Two cheap forms of apparatus suited to use on the kitchen stove are described.

Analyses of soils, W. R. PERKINS and E. B. FERRIS (*Mississippi Sta. Rpt. 1899, pp. 31–35*).—Chemical and mechanical analyses of 71 samples of soils from different parts of the State are reported.

Chemical composition of soil, J. A. MURRAY (*An. Rpt. on Field Expts. Agr. Dept. Univ. Col. Wales, 1899, pp. 75–78*).—A chemical analysis of a soil which had been in grass for several years and was rather badly drained.

Chemical methods for ascertaining the lime requirements of soils, H. J. WHEELER, B. L. HARTWELL, and C. L. SARGENT (*Rhode Island Sta. Bul. 62, pp. 65–88*).—For abstract of this article as published elsewhere, see E. S. R., 11, p. 1003.

The influence of lime on vegetation and the value of the calcimetric analysis of soils, A. GASSER and R. MAIRE (*Bul. Soc. Sci. Nancy, 2. ser., 16 (1899), No. 34, pp. 32–41*).—A study of the distribution of plants as determined by the lime content of the soil and of the value of the determination of lime in soils as a means of ascertaining the kinds of plants to which they are adapted. A bibliography of the subject is appended.

Moor culture at Tranekjär, Denmark, L. JÖRGENSEN (*Tidsskr. Landökon. 1900, No. 6, pp. 301–323*).

Soil temperatures, R. E. TRIMBLE (*Colorado Sta. Rpt. 1899, pp. 105–109*).—Tables give the weekly means of temperature at depths of 3 in. to 6 ft. in irrigated and unirrigated plats of soil on the college grounds during 1898 and 1899, and dates of extreme temperature in the irrigated plat during 1889–1899.

On the distribution of nitric-acid bacteria in some Danish soils, H. JENSEN (*Tidsskr. Landbr. Planteavl, 5 (1899), pp. 173–177*).—The investigations conducted by the author indicate that nitric-acid bacteria are not found in wild heather and moor soils, and that they appear very slowly in such soils under ordinary methods of culture. Their absence is most likely a result of the acid reaction of the soil, which is only neutralized by heavy liming or by formation of soil ammonia after several years (through aid of schizomycetes). It seems, furthermore, that the nitric-acid bacteria which appear when these new soils are cultivated are much less active than the bacteria in old cultivated soils.—F. W. WOLL.

FERTILIZERS.

On the importance of different green-manuring plants in the economy of soil nitrogen during the fall months, H. C. Larsen (*Tidsskr. Landbr. Planteavl, 5 (1899), pp. 101-112*). Pot experiments were made with the following green-manuring plants: Buckwheat, yellow mustard, field pea, common vetch, hairy vetch, Roman vetch (*Vicia sativa narbonnensis*), yellow lupine, blue lupine, and white lupine, *Medicago lupulina*, common kidney vetch, serradella, *Melilotus alba*, and red clover. Five pots were used for each plant. The pots were filled with soil of a very light character, poor in humus and other fertilizing constituents, having been taken from a field on which crops of rye, barley, three years' pasture, and oats had been grown since the last manuring. An application of sulphate of potash and superphosphate corresponding to the contents of potash and phosphoric acid in a good crop of clover was added to all pots. The pots were 21 cm. deep and 20.2 cm. in diameter. The seeding and harrowing-under of the green-manure crops were done at such a time and in such a manner as would obtain in field work. Careful records were kept of the gross yields and those of dry matter obtained in each case, and nitrogen determinations were made in the soil in the pots at the beginning of the experiments, and after the crops had been harrowed into the soil. The average results of the experiments referring to the nitrogen balance are shown in the following table:

Nitrogen contents of pots before and after manuring.

Crop.	Nitrogen in soil per pot before experiment.	Nitrogen per pot after experiment.			Gain (+) or loss (−) in nitrogen.	
		In soil.	In crop.	Total.	Per pot.	Per acre (calculated).
	Grams.	*Grams.*	*Gram.*	*Grams.*	*Gram.*	*Pounds.*
Buckwheat	7.05	6.39	0.15	6.54	−0.51	−126
Mustard	7.04	6.71	.13	6.84	− .20	− 49
Field pea	7.11	6.97	.67	7.64	+ .53	+131
Common vetch	7.12	6.59	.77	7.36	+ .24	+ 60
Hairy vetch	7.05	6.91	.33	7.24	+ .19	+ 47
Roman vetch	7.12	7.16	.50	7.66	+ .54	+134
Yellow lupine	7.14	7.03	.20	7.23	+ .09	+ 22
White lupine	7.14	7.16	.17	7.33	+ .19	+ 47
Trefoil	7.05	7.09	.16	7.25	+ .20	+ 49
Serradella	7.05	7.03	.16	7.19	+ .14	+ 35
Melilotus	7.05	7.03	.38	7.41	+ .36	+ 88

While buckwheat and mustard caused an appreciable loss of nitrogen as compared with the content in the bare soil, the legumes supplied 4 to 5 times as much nitrogen as these crops, and made the soil considerably richer in nitrogen at the end of the experiments than before, the increase corresponding to about 15 loads of barnyard manure per acre.

The pots were placed under cover over winter, and in the spring

sown to six-rowed barley. The results obtained at harvest time were rendered valueless through an accident, but the appearance of the barley throughout the vegetative period clearly showed the superiority of the legumes as green manures, and the small crops in the buckwheat and mustard pots were ripe while the barley plants in many of the legume pots, notably the field pea and the common vetch pots, were large and still green.—F. W. WOLL.

Further notes on organic nitrogen availability, C. H. JONES and B. O. WHITE (*Vermont Sta. Rpt. 1899, pp. 137–139*). An account is given of further tests of the alkaline permanganate method for determining the availability of organic nitrogen in fertilizers (E. S. R., 11, p. 328). The results are given of trials of the method on the following nitrogenous materials: Acidulated fish (nitrogen, 6.72 per cent); tankage (6.43 per cent); high grade tankage (8.33 per cent); concentrated tankage (12.99 per cent); dissolved tankage (4.51 per cent); hair tankage, wool, horn, meat, etc. (9.19 per cent); garbage tankage, New York (3.15 per cent); garbage tankage, St. Louis (4.76 per cent); garbage tankage, St. Louis (2.11 per cent); dissolved horn and hoof (11.13 per cent); hog bristles (11.29 per cent); hair (9.82 per cent); fertilizer containing cotton-seed meal as its sole source of nitrogen (2.15 per cent); cotton-seed meal fertilizer (1.72 per cent); cream gluten meal (5.87 per cent); "gluton" (1.75 per cent); Atlantic gluten meal (12.43 per cent); cocoanut fiber feed (3.63 per cent). As in previous tests, equal quantities of material and quantities of material furnishing equal amounts of nitrogen were used.

"The misleading results obtained with equal quantities of material but unequal weights of nitrogen are as evident in this as in last year's work. When, however, equal amounts of nitrogen are taken (modified method) useful results are attained.

"*Animal ammoniates.*—Not one of the better forms shows less than 56 per cent availability by the modified method, while the garbage and Philadelphia tankages, wool waste, leather and leather refuse, all of which are of well-known inferiority as fertilizers, show from 41 to 18 per cent availability. Hair tankage and hog bristles range unexpectedly high.

"*Vegetable ammoniates.*—The modified method was found in last year's experience less satisfactory with vegetable than with animal ammoniates. It seemed probable that the low availability found with cotton seed, flax, and gluten meals, materials well known to be effective in actual field use, was due to the relatively large content of nonnitrogenous organic matter. This conjecture was borne out by the lowered results on high-grade animal ammoniates when filter paper, starch, etc., were digested with them, as well as by the higher figures obtained with a vegetable ammoniate after it has been acidulated for many months. In order to throw more light upon this question a highly proteinous vegetable by-product, Atlantic gluten meal, was secured. This material carried 7.04 per cent moisture, 0.42 per cent crude ash, 77.69 per cent crude protein, 0.24 per cent crude fiber, 13.59 per cent nitrogen-free extract, and 1.02 per cent ether extract. Although belonging to the same class of material as the other glutens, it showed 70.2 per cent nitrogen availability instead of 46 and 30 per cents. It seems safe to ascribe this result to the low percentage (14.85) of nonnitrogenous organic matter.

"It was pointed out in the last report that the more tedious pepsin-digestion process, which should be used as an adjunct to the modified permanganate method and in all cases of doubt, does justice to vegetable ammoniates."

Contribution to the knowledge of the injurious effect of nitrate of soda on vegetation, J. STOKLASA (*Ztschr. Landw. Versuchsw. Oesterr., 3 (1900), p. 35; abs. in Chem. Ztg., 24 (1900), No. 20, Repert., p. 65*). It was demonstrated by means of water cultures that rye is much more sensitive to perchlorate than barley or wheat, and particularly sugar beets, the latter being 10 times more resistant than the rye. In fact, it was found that copper and zinc sulphates and arsenic were more poisonous to beets than potassium perchlorate. Five hundred kilograms per hectare of nitrate of soda containing 2 per cent perchlorate may be applied to sugar beets without appreciable injury. For rye the limit is 100 kg. per hectare of 1 per cent perchlorate, while for oats the nitrate may contain 1.5 per cent perchlorate, and for wheat and barley 2 per cent.

Fertilizers, E. FULMER and W. H. HEILEMAN (*Washington Sta. Bul. 40, pp. 32*).—A general discussion of the principles underlying the use of fertilizers and of the sources and composition of fertilizers, with the text of the fertilizer law passed by the legislature of Washington and approved March 8, 1899. This law puts the inspection of fertilizers in charge of the chemist of the Washington Station, who is created State chemist *ex officio*. The chemist is authorized to collect samples, in person or by deputy, in the open market. An analysis fee of $6 for each fertilizing ingredient contained or claimed to exist in the fertilizer offered for sale is required, the fees being paid into the treasury of the station. There is a provision against the use of pulverized leather, raw, steamed, roasted, or in any form, without an explicit statement of the fact. Violations of the law are punishable by a fine of $50 for the first offense and $100 for each subsequent offense. Fertilizers selling for less than $10 per ton are exempt.

Sea algæ as fertilizers, C. SÖRENSEN (*Landmandsblad, 33 (1900), No. 8, pp. 109–112*).

Experiments with urine and liquid manure, N. A. HANSEN (*Landmandsblad, 33 (1900), No. 7–8, pp. 77–79, 98–101*).

Local fertilizer experiments in Denmark and Germany, M. WEIBULL (*Meddel. K. Landtbr. Styr., 1899, No. 11, pp. 1–26*).

On the application of artificial fertilizers, F. H. WERENSKIOLD (*Norsk Landmandsblad, 19 (1900), No. 20, pp. 224–228*).

Analyses of commercial fertilizers and manurial substances, C. A. GOESSMANN (*Massachusetts Hatch Sta. Bul. 65, pp. 14*).—This bulletin gives instructions regarding the sampling of fertilizers, discusses the trade values of fertilizing materials, and reports analyses of 62 samples of fertilizing materials, including wood ashes, cotton-hull ashes, cotton-seed meal, tankage, sewage sludge, cork dust, kiln dust from breweries, cotton waste, tobacco refuse, muck, soils, bone, and compound fertilizers.

Report of the chemist, C. A. Goessmann et al. (*Massachusetts Hatch Sta. Rpt. 1899, pp. 108–122*).—This is a brief general account of the fertilizer inspection and of general work in the chemical laboratory of the station. It includes tables showing the average composition and agreement with guarantees of the fertilizers examined in 1898 and 1899; trade values of fertilizing materials; the quality of wood ashes analyzed in 1898 and 1899; analyses of 2 samples of hen manure; a list of licensed fertilizer dealers in Massachusetts, and miscellaneous notes on fertilizers.

Fertilizers, F. W. Morse (*New Hampshire Sta. Bul. 69, pp. 14*).—This bulletin includes a schedule of trade values of fertilizing materials in 1899, brief statements regarding the fertilizer inspection, and tabulated analyses of 97 samples of fertilizers examined for the State Board of Agriculture during 1899.

Report of analyses of commercial fertilizers for the fall of 1899, L. L. Van Slyke (*New York State Sta. Bul. 173, pp. 531–552*).—The results of analyses of 130 different brands of fertilizers are reported. Of these 101 were complete fertilizers in which the nitrogen varied from 0.59 to 4.91 per cent, averaging 1.65 per cent. The available phosphoric acid varied from 3.44 to 13.08 per cent, averaging 9.04 per cent. The potash varied from 0.48 to 10.75 per cent, averaging 4.3 per cent. The average amounts of nitrogen, available phosphoric acid, and potash exceeded the guaranteed averages by 0.13, 0.74, and 0.22 per cent, respectively.

Analyses of commercial fertilizers, J. L. Hills, C. H. Jones, and B. O. White (*Vermont Sta. Bul. 77, pp. 141–162*).—This bulletin discusses the valuation of fertilizers and reports analyses and valuations of 39 samples of fertilizers licensed for sale in the State up to April, 1900, with tables showing the average composition of all fertilizers examined by the station during the past 5 years.

Fertilizers and fertilizing materials, C. H. Jones and B. O. White (*Vermont Sta. Rpt. 1899, pp. 148–150*).—Analyses of 15 samples of home-mixed fertilizers, 28 samples of wood ashes, 7 samples of muck, 1 of cotton waste, and 2 of miscellaneous materials are reported.

"Twenty-six samples [of ashes], said to be unleached, varied from 3.24 to 9.76 per cent soluble potash, 3.66 to 10.05 per cent total potash, 1.06 to 3.41 per cent total phosphoric acid, 19.92 to 55.80 per cent lime, and averaged 5.27, 6.05, 1.68, 34.82 per cent, respectively, in the same ingredients."

Commercial fertilizers, J. H. Stewart and B. H. Hite (*West Virginia Sta. Bul. 63, pp. 115–152*).—This gives the text of the State fertilizer law, statistics of the value and consumption of fertilizers in West Virginia during the last 5 years, and analyses and valuations of 204 brands of fertilizers registered for sale in the State during 1899. It is estimated that the consumption of commercial fertilizers of all classes in the State increased from 21,559 tons in 1895 to 39,106 tons in 1899, or 81 per cent. The greatest increase was in case of acid phosphate with potash—368 per cent.

Analyses of licensed commercial fertilizers, 1900, F. W. Woll and A. Vivian (*Wisconsin Sta. Bul. 81, pp. 10*).—This bulletin gives the text of the State fertilizer law and reports 7 analyses of fertilizers with explanatory notes

FIELD CROPS.

Report of the agriculturist, W. P. Brooks and H. M. Thomson (*Massachusetts Hatch Sta. Rpt. 1899, pp. 9–49.*) This report covers fertilizer, soil, and variety tests with a number of field and garden crops, and is in continuation of similar work previously noted (E. S. R., 10. p. 626). Pot experiments have been made with potatoes, onions, soy beans, corn, and millet.

Corn was grown on plats used continuously for 11 years in soil tests with different fertilizers, alone and combined. The experiments of 1898 with corn on the same plats had shown a decrease in yield on the plat which had received annual applications of muriate of potash at the rate of 160 lbs. per acre. It was thought that the continued use of the muriate form of potash had resulted in depleting the soil of lime, and hence lime at the rate of 1 ton per acre was added to the plats in 1899. The results were very beneficial on the muriate plat, the yield of shelled corn being at the rate of 49.75 bu. per acre. Other experiments, not recorded in detail, show "that the benefit from the lime was not due to the fact that it corrected soil acidity." The yield of shelled corn on the plat which received barnyard manure at the rate of 5 cords per acre for each of the 11 years of the test was at the rate of 75.88 bu. per acre, while the yield on the plat receiving complete commercial fertilizers was at the rate of 72.88 bu. per acre. Five cords of barnyard manure would cost if purchased about $25, while the complete fertilizers cost about $10. The financial profits for the whole 11 years with the different crops grown are in favor of the complete commercial fertilizers.

A soil test similar in character to the above was made on another series of plats which have been 10 years under trial. Onions were grown in 1899 and one-half of each plat limed at the rate of 1 ton per acre. The yields on the limed and unlimed portions of each plat are tabulated and the results obtained in the years 1898 and 1899 discussed. Beneficial effects of the lime on the muriate of potash plats were again shown, and it is concluded from the experiment that the muriate of potash is an undesirable form of potash for onions.

In a comparison of the relative value of 8,825 lbs. of barnyard manure alone vs. 5,880 lbs. of barnyard manure and 40 lbs. of high-grade sulphate of potash for corn, the best and cheapest yields were made by the combination of the lesser amount of barnyard manure with the potash. The results of a comparison for 9 years of a special corn fertilizer with a fertilizer containing a larger amount of potash for corn were slightly in favor of the special corn fertilizer, but it is believed "by the frequent introduction of clover the fertilizer richer in potash will prove superior to the other."

Tests have been under way for a number of years with muriate vs. sulphate of potash for a number of crops. In 1899 the largest yield of sugar beets was obtained on the muriate plats, but the sugar content and the degree of purity of the juice were higher in beets grown on the plats fertilized with sulphate of potash. The results obtained with the 2 fertilizers as regards yield and composition of both sweet and field corn were practically identical. With cabbage the greater number of hard heads and the greater total yield was afforded by the plats fertilized with the sulphate of potash.

A test with 7 different forms of potash for soy beans was begun in 1898 and continued with potatoes in 1899. All the different forms used increased the yields, but the yields from the same potash salt on the duplicate plats did not always occupy the same relative rank. The best average yield for potatoes was obtained on the high-grade sulphate plat. Plats receiving carbonate of potash-magnesia ranked second, and the low-grade sulphate plats third. Kainit ranked lowest in yield of all the salts employed.

Experiments with leguminous crops as nitrogen gatherers seemed to show no benefit to the succeeding crops from growing soy beans. Clover gave nearly as good average results on plats which had received no nitrogenous fertilizers for 11 years as on the plats which had been well fertilized with different forms of nitrogen during that time. Tests of different forms of nitrogen for farm crops showed them to rank on the average in the following order: Nitrate of soda, barnyard manure, dried blood, and sulphate of ammonia.

Experiments have been under way since 1891 to test the relative value for garden crops of (1) sulphate of ammonia, nitrate of soda, and dried blood as sources of nitrogen, and (2) muriate and sulphate as sources of potash. Partially rotted stable manure was applied to all the plats in 1898 and 1899. Barnyard manure alone has given the best results with celery, spinach, onions, table beets, and squashes. Sulphate of ammonia, when used with barnyard manure, was the most satisfactory form of nitrogen for strawberries and cabbages, and nitrate of soda the most satisfactory form for celery, lettuce, spinach, and onions. Of the 2 forms of potash, the sulphate gave the best results with strawberries, celery, lettuce, spinach, onions, and cabbages.

Data for tests of 94 varieties of potatoes are tabulated. Some 36 varieties produced yields averaging over 333 bu. per acre. In the author's opinion good Northern-grown seed is of more importance than name. The following varieties have made good yields for 3 years or more: Beauty of Hebron, Dutton Seedling, Early Rose, Enormous, Fillbasket, Prolific Rose, Restaurant, State of Maine, Thorburn, Vanguard, and White Elephant.

The experiment in using wood ashes, ground bone and muriate of potash, and barnyard manure in rotation upon grass lands has been continued. The average yields of hay and rowen obtained from the plats fertilized with the different manures since 1893 have been as follows: Barnyard-manure plats, 7,027 lbs.; bone and potash, 6,568 lbs., and wood ashes, 6,294 lbs. per acre.

Report on experiments conducted by the Ontario Agricultural and Experimental Union, 1899 (*Ontario Agr. and Expt. Union Rpt. 1899, pp. 22–41*). The summarized results obtained by the union in experiments with certain field crops and fruits are reported. The experiments involved tests of commercial fertilizers for corn and

mangel-wurzels; variety tests with millet, grasses, clovers, buckwheat, spring wheat, spring rye, barley, oats, field peas, field beans, Japanese beans, carrots, mangel-wurzels, sugar beets, and Swedish and fall turnips; tests in growing grass, peas, and 2 varieties of vetches for green fodder, 3 mixtures of grain for green fodder, 6 varieties of corn for grain fodder or silage; sowing peas at different dates to determine the amount of injury done by the pea weevil; planting potatoes the same day and 5 days after being cut; and planting corn in rows and in squares.

In the experiment in planting peas at different dates it was found that the percentage of weevily peas as well as the total yield decreased as the date of seeding advanced, the yield of peas sown on June 6 being only about one-third as great as from peas sown on April 30. Planting seed potatoes immediately after they were cut yielded on the average 12 bu. more per acre than was obtained from seed planted 5 days after being cut. Corn grown in squares gave a larger yield than when planted in drills, the experimenters deciding in the proportion of 14.1 in favor of planting by this method.

Report of the Arkansas Valley Substation, H. H. GRIFFIN (*Colorado Sta. Rpt. 1899, pp. 55–70, fig. 1*).—A report on the culture and yield of wheat, corn, alfalfa, plants for green manuring, pasture and forage, cantaloupes, potatoes, celery, sugar beets, beans, and certain orchard and small fruits. In some cases results of irrigation experiments are included. The results of a feeding test are noted elsewhere in this issue (p. 275).

Three irrigations proved as effective as 7 for cantaloupes. The yields in both cases were larger than where only one irrigation was given, but the quality of the cantaloupes was more satisfactory with the one irrigation. Cantaloupes grown on alfalfa sod gave better yields and fruit of better quality than when grown on other soils and fertilized with barnyard manure or bone dust. Transplanting vines started in the greenhouse gave a larger proportion of early fruits than was obtained when the seeds were grown in hills in the open field.

Paris green was used effectively as a remedy against the black flea-beetle, and Bordeaux mixture against the leaf blight of cantaloupes. The percentage of sugar in the juice of the sugar beets grown varied from 13.8 to 16.9, and the purity from 80 to 86.8. Some data are given on the cost of growing sugar beets, but they are not reduced to any common unit of comparison.

Field experiments, E. R. LLOYD (*Mississippi Sta. Rpt. 1899, pp. 9–13*).—Variety tests with cotton and wheat, fertilizer tests with cotton, and culture experiments with hairy vetch (*Vicia villosa*) are briefly reported.

The heaviest yields of the 20 varieties of cotton grown were afforded by Hawkins Jumbo and Texas Bur, each producing over 700 lbs. of

seed cotton per acre. In a fertilizer test with cotton, the use of 2,000 lbs. of compost applied in the drill resulted in heavier yields than cotton-seed meal, lime, acid phosphate, or kainit, alone or combined.

The heaviest yields of wheat were afforded by Eclipse, Beardless Fulcaster, Fulcaster, and Red May, the yields varying from 18.9 bu. in the first instance to 11.45 bu. in the last.

Sowing hairy vetch broadcast at the rate of 53 lbs. per acre resulted in a heavier yield of seed than sowing either 83 or 37 lbs. in drills 2½ ft. apart. Heavy freezing did not injure early sowings of vetch.

Field crops, 1899, F. C. Burtis et al. (*Oklahoma Sta. Bul. 44, pp. 12*).—Variety tests with oats and culture experiments as regards time of seeding, thickness of planting, and methods of plowing and cultivation are recorded with Kafir corn, Indian corn, castor beans, and cotton. The data of the different experiments are tabulated. The authors summarize the results obtained as follows:

"(1) With oats, early seeding of an early-maturing variety has given best results.

"(2) With Kafir corn, planting about the middle of May in rows 3 ft. apart with one stalk each 3 to 5 in. has generally given the highest yields.

"(3) With corn, no definite differences in yield were produced by variations in thickness of planting or in methods of plowing and cultivation.

"(4) With castor beans, no difference in yield was obtained from planting weekly from March 21 to April 26. Planting May 16 gave the lowest yield. Manuring more than doubled the yield.

"(5) With cotton, tests of time and thickness of planting gave no conclusive results. Planting from April 15 to May 15 in rows 3 to 3½ ft. apart, and chopping to 1 stalk to each 18 in. is the general practice of cotton growers in eastern central Oklahoma."

Brief notes are added to the bulletin on the experience of farmers of the Territory in cotton culture and on the growth of cowpeas at the station.

Progress of experiments in forage crops and range improvement at Abilene, Tex., H. L. Bentley (*U. S. Dept. Agr., Division of Agrostology Circ. 23, pp. 20, fig. 1*).—The general plan of these experiments, begun in 1898, has been previously outlined (E. S. R., 10, p. 1005). This report covers the second year of the test. As a result of the cultivation and rest given, the grazing capacity of the range under observation has doubled after a little more than one year's treatment. The author concludes "(1) that it will pay farmers and stockmen of Texas, especially in the semiarid districts of the State, to cultivate their pastures by use of disk and iron-tooth harrows; (2) that it will pay them to rest their pastures periodically during the seasons when the grass seeds are maturing and falling to the ground."

A further experiment has been added to those already under way in plowing furrows about 12 ft. apart in the pastures and running crosswise to the generally prevailing winds. The purpose of the furrows is to catch the grass seeds of the pasture which ripen and may

otherwise be blown away. They further serve to catch and hold surplus rain water. Pasture lands thus treated have given good results, many grass seeds being caught in the furrows, and the grass on each side has remained green for a much longer period than elsewhere. Transplanting grass roots on patches made bare of vegetation by overgrazing has been successfully accomplished.

A large number of grasses, legumes, and other forage plants have been tested on experimental plats. These are reported upon in detail. The weather conditions of the season were very unfavorable, but in spite of this drawback the experiments have yielded results of considerable value.

"They have demonstrated the availability of alfalfa (especially oasis alfalfa), sulla, sainfoin, smooth brome, Canada rye grass, Terrell grass, and others for use in permanent pastures and meadows; of the vetches, cowpeas, velvet bean, soy bean, teosinte, and a larger number of varieties of the sorghums and millets for annual or temporary pastures, and as sources of coarse forage, either fresh or cured; of saltbush for alkali soils; of the gramas, Canada rye grass, grapevine mesquite, curly mesquite, galleta, and needle grass for reseeding the worn-out ranges. They have shown the feasibility of range improvement by resting and scarifying the land and by sowing hardy native and introduced grasses."

An experiment was made in baling legumes and sorghums. Several varieties of beans and peas were planted and when the fruits were nearly grown, but before they began to turn yellow, the vines were cut and cured as hay, after which they were baled. "Recent examination showed that the hay was as sweet as when first baled." A similar experiment was successfully carried out with sorghum. The stalks were cut when they were from 3 to 5 ft. tall and when the seeds were in the dough stage. The sorghum kept well and the bales were easily handled. Since these crops can be grown in all parts of Texas nearly every year, it is thought that the industry may become of considerable commercial importance in supplying forage to sections of country farther west.

Egyptian cotton in the United States, L. H. DEWEY (*U. S. Dept. Agr., Division of Botany Circ. 26, pp. 9*).—This circular reviews the results obtained in the earlier and in the more recent experiments with Egyptian cotton in this country, giving descriptions of 3 varieties of Egyptian cotton and instituting a comparison of the soil and climatic conditions of the 2 countries relative to cotton-growing areas. Egyptian cotton, apparently fully equal to the imported product, has been successfully grown in southern Texas from selected acclimated seed, and a successful hybrid has been obtained by crossing Mitafifi Egyptian with Myers Big Boll. The hybrid is said to produce a fiber very similar to the Egyptian product and in some respects superior to the Egyptian. In the opinion of the author the area which can be devoted to the culture of Egyptian cotton on a commercial scale in this country must necessarily be confined to the Gulf coast region, where the season

, long, and to the irrigated lands of the Southwest, the climatic and soil conditions of these regions being more similar to the Egyptian conditions than elsewhere in the United States.

Cowpeas and corn for silage and fodder, W. GETTYS (*U. S. Dept. Agr., Division of Agrostology Circ. 24, pp. 10, figs. 2*).—The desirability and practical possibility of growing corn and cowpeas together for silage and forage purposes are set forth by the author, his own experience in growing, handling, and feeding these crops being made the basis of the discussion.

Details as regards the author's methods of planting, cultivating, and harvesting the crops together are given. Whip-poor-will cowpea is considered the best variety for growing with corn. No noticeably injurious effect on the quality of the butter has been observed from feeding corn-and-cowpea silage to milch cows. Sowing cowpeas as a catch crop after wheat proved profitable in the author's experience. The pea vines were used for forage and the peas saved separately.

Influence of the time of harvesting on the yield and quality of hops, W. BEHREND (*Bl. Gersten, Hopfen, und Kartoffelbau 1 (1899), No. 12, pp. 465–473*). Hops were gathered at regular intervals of 5 days each from August 25, when they were of a pure green color, to September 14, when they were of a yellowish color, flecked with reddish specks. The yields of fresh and air-dried hops, amount of resin and coloring material in the hops at different dates of gathering, and the character of the beer made with them were determined.

The late harvested hops gave the more satisfactory results in nearly every respect. In yield of air-dry substance and resin content, and in the taste and character of the beer made from the hops, each later harvest surpassed the one preceding. Relative to the fermentation period, acid content of the beer, and the color of the beer, no differences traceable to differences in the harvesting period could be detected. The content of coloring material in the hops decreased with the lateness of the harvesting.

The results of the investigation lead to the conclusion that the best time for harvesting hops is shortly after the appearance of the characteristic yellow color and reddish-colored flecks.

Influence of size of seed tubers on the yield of potatoes, CLAUSEN (*Landw. Wchnbl. Schleswig-Holstein, 50 (1900), No. 4, pp. 63–64*). Experiments were made in planting Danish, English, and Blue Six Weeks seed potatoes of different sizes under like conditions on good soil. In every instance the greatest yields were obtained from the largest-sized seed, and the largest proportional gains were made by the early Blue Six Weeks potatoes. The author draws the following conclusions from the results obtained in the experiments: Large seed tubers insure, through the greater amount of nourishment which they furnish to the young plants, a stronger growth and a bet-

ter yield than small tubers. This result is especially noticeable in dry seasons. Early maturing varieties are more benefited by planting large seed tubers than varieties having a longer period of vegetation. Large seed tubers are especially desirable in light soils.

Culture of wheat and oats on the experimental fields at Grignon, P. P. Dehérain (*Ann. Agron., 26 (1900), No. 1, pp. 20–33*).—The relative values of large and small grains for seed wheat, and the proper place for oats in a system of field rotation were investigated. Both crops were sown in fields on which crops of beets, potatoes, or clover had been cultivated the preceding season. The yields of wheat obtained from the plats seeded with large grains were slightly better than those where small seed had been used. The best results with both wheat and oats were obtained on the plats which had grown a crop of beets the preceding season, and the poorest results from the field which had been in clover.

Report of the agricultural department, J. H. Shepperd (*North Dakota Sta. Rpt. 1899, pp. 41–45*).—A short outline review of the work of the department during the year, with a reprint of the conclusions in bulletins 38 to 40 of the station.

Report of barley experiments in Denmark during 1898, C. Sonne (*Tidsskr. Landbr. Planteavl, 5 (1899), pp. 148–172*).

Report of culture experiments with malt barley during 1897, C. Sonne (*Tidsskr. Landbr. Planteavl, 5 (1899), pp. 39–62*).

Malt barley and its culture in Norway, A. Krogvig (*Tidsskr. Norske Landbr., 7 (1900), No. 4, pp. 145–155*).

Studies of plant variation and improvement, with special reference to Goldthorpe barley, W. Johannsen (*Tidsskr. Landbr. Planteavl, 5 (1899), pp. 63–90*).—The author gives data and discussions bearing on the relation of grain weight to the Nitrogen content of Goldthorpe barley, and the effect of different factors on this relation, like growing place, time of sowing, thickness of sowing, influence of season, etc.—F. W. WOLL.

Investigation of the quality of upper Bavarian barley grown in 1899, R. Ulrich (*Vrtljschr. Bayer. Landw. Rathes, 5 (1900), No. 2, pp. 125–137*).—Comparative data as to the physical characteristics, germinative power, color, odor, specific gravity, etc., of barley grown in 20 different districts of Bavaria.

The harvest and sale of barley (*Deut. Landw. Presse, 27 (1900), No. 55, p. 699*).—An abstract is here made of an article on this subject by Remy. From the figures given it is shown that the yellow ripe stage is the earliest condition in which barley should be cut. For brewing purposes, however, it increases in value up to the dead ripe stage.

Some analyses of Norwegian barley, F. H. Werenskiold (*Tidsskr. Norske Landbr., 7 (1900), No. 2, pp. 68–74*).—Complete analyses of 10 samples of 6-rowed barley and 7 of 2-rowed barley are given, with discussion of their malting qualities and other characteristics. All but 4 of the samples were grown in Norway. In No. 3, pp. 109–114, of the same periodical, the author gives additional analyses of Norwegian barley.—F. W. WOLL.

Tests of commercial fertilizers on maize, A. Carré (*Semaine Agr., 20 (1900), No. 999, pp. 218, 219*). In Haute-Garonne nitrate of soda was especially valuable for corn in dry years. In rainy years the nitrate caused an excessive growth of stalk as compared with the grain yield. In such years superphosphate and potash increased the grain yield. A formula containing from 400 to 600 kg. of superphosphate and 200 kg. of nitrate of soda, applied in drills, is recommended for the soils of the district.

Forage crops, J. S. MOORE (*Mississippi Sta. Rpt. 1899, pp. 29, 30*).—Data on the yield of sorghum, velvet beans, and Dwarf Essex rape grown at the station. Sorghum planted in rows 3 ft. apart yielded at the rate of 8.95 tons of field-cured hay per acre; planted broadcast with peas, 5.86 tons per acre; and planted broadcast alone, 4.24 tons per acre. When planted September 15 in rows 3 ft. apart sorghum yielded at the rate of 5.65 tons of hay, containing 10 per cent moisture, 2 months from date of planting.

Analyses of sorghum and forage plants, W. R. PERKINS and E. B. FERRIS (*Mississippi Sta. Rpt. 1899, pp. 39, 40*).—Analyses with reference to the sugar content of 23 samples of sorghum and food analyses of carpet grass; kidney bean; sorghum hay; rape, sun dried; corn and cob, glazed stage; corn fodder; corn tops; prepared feed; velvet-bean hay; Johnson grass hay; peavine hay; cotton seed; cotton-seed meal; wheat shorts; wheat bran; corn-and-cob meal; corn silage; rape, winter grown; and sorghum silage.

Sundry forage crops, J. L. HILLS (*Vermont Sta. Rpt. 1899, p. 308*).—The relative productiveness and composition of 6 nonsaccharine sorghums, soy beans, and 2 vetches grown from seed imported from Russia by this Department are shown in a table. The sorghums tested were not thought adapted to Vermont. The soy bean was considered a promising forage crop. The vetches from imported seed did no better than crops grown from domestic seed.

Forage plants in Washington, W. J. SPILLMAN (*Washington Sta. Bul. 41, pp. 60, map 1, figs. 10*).—Part 1 of this bulletin discusses the climatic divisions of the State, giving notes on the wheat-growing, grazing, and alfalfa sections; and part 2, the leguminous grasses and other forage plants which may be grown in the State, with cultural notes and the results that have been thus far obtained with some of different species at the experiment station. Part 3 classifies Washington farm crops with especial reference to the different sections of the State, and part 4 gives suggestions with regard to the seeding and management of pastures and meadows. A rainfall map of the State concludes the bulletin.

Conversion of arable land to pasture, W. J. MALDEN (*London: Kegan Paul, Trench, Trübner & Co., 1898, pp. 190*).

Lupines and vetches for winter growth (*California Fruit Grower, 25 (1900), No. 638, p. 5*).—Notes on the different varieties of lupines and vetches which have been grown at the State agricultural experiment station and substations, with recommendations as to seeding and directions for obtaining seed.

Varieties of oats compared (*Queensland Agr. Jour., 7 (1900), No. 1, p. 12*).—An account of some experiments with oats conducted by R. P. Wright at the West of Scotland Agricultural College is given. Tam Finlay was the best all-round variety grown, so far as yield of straw was concerned. It tillered best and was the latest variety grown. Tartar King was the earliest variety grown, while Pioneer gave the largest yield of grain.

The selection of potatoes for seed purposes, H. L. BOLLEY (*North Dakota Sta. Rpt. 1899, p. 28*).—The work of testing the value of large and small potatoes from the same vine for seed purposes was continued for the sixth season (E. S. R., 9, p. 942), using 5 varieties of potatoes. The seed tubers used were selected from the preceding year's pedigreed crop.

"The results again affirm those of previous years. A mature bud from one vine thus proved to be as good as any other from the same vine when furnished with the same weight of tuber piece. During six seasons of continuous selection of a small potato from the same vine or strain the work has not tended to 'run out' the crop. The products from this sort of selection seem to have been each year neither better nor worse than those from the line of selection in which the biggest and best tuber was always taken. Soil and cultivation seem to be the main elements in causing a variation in the standard of a potato strain."

Tests of varities of potatoes in 1898, A. Flückiger (*Jahresber. Landw. Schule Rütti, 1898–99, pp. 76–80*).—In addition to data as to the yields of 28 varieties, suggestions regarding the handling of seed potatoes are given. It is considered good practice in early spring to place the potatoes in dry sand. This induces a shrinking up of the tubers and prevents sprouting until they are planted. Potatoes thus treated have given from 22 to 30 per cent higher yields.

Wheat straw for potatoes, A. M. Howell (*Agr. Gaz. New South Wales, 11 (1900), No. 1, pp. 45–47*).—Discussion of the use and value of straw as a mulch for potatoes.

Fertilizer experiments with potatoes, E. Zacharewicz (*Prog. Agr. et Vit. (Éd. L'Est), 21 (1900), No. 16, pp. 484–487*).—Oil meal was compared with a mixture of oil meal, chlorid of potash, and superphosphate and with complete commercial fertilizers for potatoes on a soil rich in nitrogen but poor in potash and phosphoric acid. The amounts of the fertilizers used in each instance and the yields obtained with 2 varieties of potatoes are tabulated. The profit from the use of the oil meal alone was $63.11; from the oil meal and mineral fertilizers, $102.96, and from complete commercial fertilizers, $283.90 per hectare.

Rice culture in the United States, S. A. Knapp (*U. S. Dept. Agr., Farmers' Bul. 110, pp. 28*).—This is a popular bulletin based on Bulletin 22 of the Division of Botany of this Department (E. S. R., 12, p. 46). Varieties of rice grown in this country, rice-growing sections, importation and production of rice, rice lands, methods of culture and milling, value as a food, rice by-products, effects of fashion in rice, new wholesale methods of rice production in Louisiana and Texas, prospects of the extension of the rice industry, labor problems, etc., are the principal subjects considered. An impetus of considerable importance has lately been given to the rice industry in this country by the introduction of the Japanese variety of rice Kiushu, which is about 25 per cent more productive than the Honduras variety usually grown, and which possesses superior milling qualities.

On the cultivation and treating of rice in Jamaica, R. H. Lindo (*Jour. Jamaica Agr. Soc., 4 (1900), No. 7, pp. 435–444*).—Complete cultural directions are given, including thrashing, drying, hulling, and preparing for market.

Peculiar frost injuries to rye, Frank (*Deut. Landw. Presse, 27 (1900), No. 51, p. 653, figs. 2*).—Late frosts in May seriously injured rye. Some plants were entirely killed and others only slightly affected. Plants injured to different degrees, as shown by after growth, are figured and described.

Sugar beets at the experiment station at Capelle, Desprez Sons (*Jour. Agr. Prat., 1900, II, No. 31, pp. 160, 161; Semaine Agr., 20 (1900), No. 1002, p. 242*).—The comparative yields per square meter of roots and leaves of sugar beets, percentage sugar content and purity of the juice, etc., are given for 4 experimental plats for each of the years 1896–1900. The beets were harvested July 22 of each year.

Sugar beets, C. H. Jones and B. O. White (*Vermont Sta. Rpt. 1899, pp. 146, 147*).—The average weight of beets grown in 1898 was 20 oz.; average sugar content, 13.3 per cent; purity coefficient, 83.1 per cent. From results attained the authors conclude that, though a good grade of beets may be grown in Vermont, yet, owing to the restricted area and short growing season, it will be difficult, if not impossible, to establish the sugar industry in the State.

Sugar beet experiments, E. F. Ladd (*North Dakota Sta. Rpt. 1899, pp. 14–17*).—The analyses of 82 samples of sugar beets grown in cooperative experiments with farmers throughout the State are given. They show an average of 12.9 per cent sugar content with a coefficient of purity of 78 per cent. The season was not favorable for best results. See E. S. R., 11, p. 241, for an account of similar work in 1898.

The work of the agricultural experiment stations on tobacco, J. I. Schulte and M. Whitney (*U. S. Dept. Agr. Rpt. 63, pp. 48*).—A summary is here given of the results obtained in all the experimental work thus far undertaken by the agricultural experiment stations in this country and Canada in the growing, curing, and handling of tobacco; and suggestions given regarding further experimental work.

Cultivation of tobacco, J. M. Priego (*El cultivo del tabaco. Madrid: M. G. Hernández, 1899, pp. 130, pl. 1. Biblioteca del agricultor, v. 1*).

Tobacco, its culture and biology, C. J. Koning (*Leipsic: Wilhelm Engelmann, 1900, pp. 85, figs. 15*).

Growing tobacco under cover (*Tradesman, 43 (1900), No. 11, p. 59*).—Some figures on the growing of tobacco under slat arbors and arbors covered with cheese cloth in Florida are given and methods of overhead irrigation of the tobacco by revolving sprinklers noted.

Tobacco: Methods of culture and manufacture, M. M. Garcia (*Tabaco: nociones de cultivo y elaboración. Valencia: Imp. de El correo de Valencia, 1899, pp. 44, pl. 1*).

Observations on the growth and products of wheat plants of known selected pedigree, H. L. Bolley (*North Dakota Sta. Rpt. 1899, pp. 19, 20*).—This is an account of the comparative yields for 2 seasons of large grains of seed wheat selected from plants grown from large grains and of small grains selected from plants grown from small grains. The yields obtained from the large seed have been the better. The experiment is being continued.

HORTICULTURE.

The fertilizer requirements of asparagus, J. Honig and E. Haselhoff (*Braunschweig. Landw. Ztg., 68 (1900), Nos. 23, pp. 102, 103; 24, p. 106*). In addition to the authors' experiments here reported, the works of Paschen, Lierke, and Colomb on the culture and analysis of asparagus are drawn upon. The average weight and composition of asparagus on a hectare are shown to be as follows:

Yield and composition of asparagus.

	Fresh weight.	Dry matter.		Nitrogen.	Phosphoric acid.	Potash.
	Kg.	*Per cent.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*
Asparagus stalks	4,000	6.25	250	12,875	4,375	10,625
Asparagus berries	600	29.00	175	6,000	1,580	4,935
Whole plant, without berries	9,000	23.00	3,000	47,100	10,770	63,900
Total				65,975	16,725	79,460

The fertilizing requirements of a crop of asparagus is thus seen to be about 58.9 lbs. of nitrogen, 15.2 lbs. of phosphoric acid, and 71.77 lbs. of potash per acre. These figures increased or decreased by about one-third give the maximum and minimum limits, respectively, of these elements required by a crop in different seasons. About 18,000 lbs. of cattle manure would supply asparagus with all the essential elements required for a crop grown on one acre. A number of fertilizer formulas containing commercial fertilizer and furnishing nitrogen, phosphoric acid, and potash in about the right proportions for asparagus are given.

The South Haven report for 1899, L. R. Taft and S. H. Fulton (*Michigan Sta. Bul. 177, pp. 17–56*).—This is a report on tests of varieties of fruits similar in character to those previously reported (E. S. R., 10, p. 49). Some work in spraying, pruning, and fertilizing is briefly noted, and tabular matter given which shows the blooming

and ripening periods, characteristics of the form, color, etc., of 151 varieties of strawberries, 62 raspberries, 29 blackberries, 23 currants, 20 gooseberries, 69 cherries, 49 peaches, 55 pears, 10 quinces, 46 plums, 103 grapes, and 122 apples. Brief notes on a number of varieties of nuts, including almonds, chestnuts, filberts, and walnuts, are also given, together with descriptions of a number of varieties of fruits which have not been described in previous reports of the station.

Following the severe freeze of the winter of 1898, experiments were made in pruning back peach trees which had been more or less injured. The authors summarize the results obtained in this experiment briefly as follows:

"Very severe pruning or removing all the tops down to the stumps of main branches proved dangerous to the life of the trees. More moderate pruning or cutting back on branches from one-half to three-fourths of an inch in diameter gave good results. Trees pruned in the ordinary way were not, at the close of the season, in quite so good condition as those pruned more severely. These results are not considered conclusive."

Early spraying with copper sulphate solution in March proved, under ordinary conditions, an effectual remedy for leaf curl.

Pollination in orchards, S. W. FLETCHER (*New York Cornell Sta. Bul. 181, pp. 340-364, figs. 23*).—This bulletin discusses popularly various reasons why flowers of orchard trees often fail to set fruit, and the general subject of self-sterility of orchard fruits, giving suggestions based on the experience of the author and others as to the planting of mixed orchards so as to overcome these defects.

Vigorous growth of wood, fungus diseases, frost injury, and continuous rain during the blooming season are given as some of the factors which prevent the setting of fruit. "In general the cause of self-sterility is that the pollen of a variety is unable to fertilize the pistils of that same variety." Self sterility, however, is not a constant character, and some varieties which are self-sterile under certain conditions may be nearly self-fertile under more favorable conditions. Orchard fruits can not be separated into self-sterile and self-fertile varieties. The following list, based on the author's experience and on the reports of over 500 fruit growers, is considered a conservative list of varieties which tend toward self-sterility, and which, therefore, should not be planted alone in large blocks:

"*Pears.*—Angouleme (Duchess), Bartlett, Clapp, Idaho, Kieffer, Nelis. *Apples.*—Bellflower, Primate, Spitzenburg, Willow Twig, Winesap. *Plums.*—Coe Golden Drop, French Prune, Italian Prune, Kelsey, Marianna, Miner, Ogon, Peach, Satsuma, Wild Goose, and, according to Waugh and Kerr, all other varieties of native plums except Robinson. *Peach.*—Susquehanna. *Apricot.*—White Nicholas. *Cherries.*—Napoleon, Belle de Choisy, Reine Hortense. Most of these varieties are self-fertile in some places, but the weight of evidence shows them to be uncertain."

The mutual affinity of certain varieties for cross pollinating each other, the necessity for planting with self-sterile trees, trees which

may serve as pollinizers for them, and the good effects of cross pollination over self-pollination of certain varieties, are discussed at considerable length. The results obtained at the station in self and cross pollinating experiments with a number of varieties of different fruits are shown by the aid of figures. Suggestions are also given regarding the selection, distribution, and planting of trees largely intended as pollinizers in orchards. The advantages of generally mixed plantings is pointed out, and notes are given on pollen distribution by the aid of wind and insects.

Report of the horticulturist, F. A. WAUGH (*Vermont Sta. Rpt. 1899, pp. 189-251, figs. 9*).—The subjects here reported upon are the pollination of plums, types of European plums in America, hybrid plums, geography of variation in the genus Prunus in America, and varieties and culture of cherries in Vermont.

Pollination of plums (pp. 189-209, figs. 2).—This subject has been previously reported upon (E. S. R., 11, p. 347). Further work has strengthened the previous conclusions of the author, that for all practical purposes native and Japanese plums may be considered self-sterile, and that in order to insure fecundation of the blossoms varieties in orchards must be mixed. In mixing the varieties for purposes of pollination, the following points should be observed: (1) Blossoming season; (2) mutual affinity; (3) amount of pollen borne, and (4) the value of the pollenizer as a fruit bearer. The time of blossoming each year has been found quite uniform. A map with "isophenal" lines is given showing the blossoming season of Wild Goose in different latitudes for 1899. The mutual affinity of certain well-known varieties as pollenizers for each other is discussed, and a table of varieties given with a list of recommended pollenizers for each. Previous work, which demonstrated that insects are necessary to pollination, has been confirmed. The wind, if of any use in cross fertilizing plums, plays a very subordinate part. A list of insects captured on plum blossoms in Oklahoma, Maryland, Iowa, and Vermont is shown. The honeybee performs by far the greater part of the pollination. The uselessness of spraying while the trees are in blossom is pointed out.

The cause of the phenomenon known as June drop was investigated. Careful examination of the sound and fallen fruit showed this trouble to be due to 3 principal causes: (1) nonpollination; (2) curculio, and (3) the struggle of the fruit on the stem for existence. In the examination of the fallen fruit of 9 different varieties only 41 per cent had been fecundated. Nonfecundated fruit usually falls in June, while the larger amount of the fruit attacked by the curculio falls in July. A large number of fruits often set on a single fruit spur. As only a part of these can develop the weaker are crowded off, even though well fertilized and free from curculio attacks. In combating the June drop the struggle for existence may be left out of consideration.

The question of pollination is also a matter which should be considered when the orchard is set. The curculio is the factor to be guarded against, particularly as this cause may reduce the crop to a total loss.

Types of European plums in America (pp. 210–218).—Both the older and the more modern types of European plums are considered in some detail and a classification given of present day types. The following groups are distinguished: Myrobalan, Damsons, Reine Claude, Dame Aubert, prunes, Perdrigons, Diamond, Bradshaw, and Lombard. Varieties which fall under each group are noted.

Hybrid plums (pp. 218–230, figs. 2).—In this continuation of previous work (E. S. R., 11, p. 47), the question of the hybrid parentage is further discussed, the parentage of 18 known hybrids being given, together with notes of the year on 39 hybrid varieties.

Geography of variation in the genus Prunus in America (pp. 231–239).—This is a discussion of the variation of native American species of Prunus which occurs in different sections of the country, illustrated by 2 maps which show the general trend of the distribution of the several species series. Three points are made the basis of discussion: "(1) the striking parallelism of modification which obtains in the several species series; (2) the relation of this modification to geographical distribution; and (3) the application of a uniform system of nomenclature to the genus which shall exhibit the several groups in their proper relationships and with due perspective." The Americana, Chickasaw, Hortulana, Maritima, Sand Cherry, Choke Cherry, and Black Cherry series are discussed geographically and characterized; and a systematic summary given of the various series, species, and varieties. The preferred botanical names are noted with principal synonymy. In the preferred names, certain changes are suggested which "seem to help toward putting the nomenclature of the genus Prunus on a more uniform basis and to show more clearly the important natural relations existing between the various members of the several series." A fact developed in the author's study is that the Americana series of plums is continuous from New Brunswick to the Mexican border. Characteristic changes occur in the different latitudes, but "there is no break either in the geographical distribution or in the gradual morphological modification of the series."

Field notes on cherries (pp. 240–251, figs 5).—These notes are based on results obtained with a number of varieties sent out by the station to different parts of the State some years previous. In general only sour cherries succeed in Vermont, more especially those of the Morello class. Descriptive, historical, and nomenclatural notes are given on 18 varieties, followed by general, cultural, and marketing notes. The varieties recommended for use on the ordinary farm, noted in the decreasing order of their desirablity, are as follows: Morello, Montmorency, Brusseler Braun, Ragg, Bessarabian, Schatten Amarelle,

Griotte du Nord, and Juneat Amarelle. The author notes that there is a ready and profitable home market in Vermont for 25 times the amount of cherries now grown, and that cherries are easier to grow than potatoes.

Facts and opinions about plums and plum growing in Iowa, J. Craig (*Iowa Sta. Bul. 46, pp. 233–303, figs. 32*).—This bulletin sets forth some of the facts obtained in an investigation of the plum industry in Iowa relative to the character, blossoming period, hardiness, popularity, etc., of a large number of varieties grown within the State; presents an epitome of the experiences of many orchardists on plum culture in different parts of the State; describes 118 varieties of plums, and gives directions for planting, cultivating, pruning, spraying, thinning, topgrafting, selection of plum stocks, and the planting of plums with regard to cross pollination.

The relative hardiness of the fruit buds of a large number of varieties of plums grown in different parts of the State was determined by examination of buds sent in to the station in the spring of 1899. The data obtained are tabulated, and are instructive "from the standpoint of exhibiting class characteristics, varietal differences, and effect of locality upon variety."

The characteristics of all the leading types of plums, as shown by their behavior in Iowa, are summarized comparatively in tabular form. From these data the author bases his belief that the chief reliance of Iowa plum growers must be placed upon varieties of the Americana group. The improvement of this group of plums by Iowa horticulturists is pointed out. From circular letters addressed to leading fruit growers, the varieties De Soto, Hawkeye, and Wyant of the Americana group and Minor of the species Hortulana are shown to be the most popular plums grown in Iowa for both market purposes and for home use. The Domestica and Japanese plums are practically uncultivated in Iowa except in the 4 southern tiers of counties. Lombard and Green Gage of the Domestica and Burbank and Abundant of the Japanese are the favorite varieties grown.

The author suggests lists of varieties of plums for planting in each of the 9 tiers of counties of the State. The curculio, gouger, aphis, and rot are mentioned as the most serious enemies of native and Domestica plums. Of the Japanese plums, rot is the enemy of greatest importance.

Fertilizing self-sterile grapes, S. A. Beach (*New York State Sta. Bul. 169, pp. 331–371, pls. 2*).—Work of the author in testing the self-fertility of grapes has been previously noted (E. S. R., 11, p. 248). The present work reports a study of the question whether some grapes are better than others for fertilizing the self-sterile kinds. The work has been carried out in 3 different sections of the State. Cross pollination was effected by brushing the bunches of the 2 varieties to be cross

pollinated together or by inclosing the variety furnishing pollen with the variety to be pollinated in a paper bag and shaking the 2 together. Paper bags were used in each instance to prevent cross fertilization by foreign pollen.

"Twelve nearly or quite self-sterile varieties were treated with pollen from 1 or more of 24 varieties ranging from perfectly self-fertile to self-sterile. The results are given in the body of the bulletin, both in detail and summarized.

"The use of self-sterile varieties as pollenizers for other self-sterile varieties resulted in failure. Self-sterile varieties fertilized with varieties not strongly self-fertile produced clusters varying in compactness about as did the bunches of the pollinating variety. Self-fertile sorts, with rare exceptions, gave good results when used as fertilizers for either partially self-sterile or completely self-sterile varieties. From study of the effect of pollen from different varieties upon the same self-sterile variety, it seems probable that failure to set fruit may be due to several causes, such as dropping off of blossom buds before they open or poor condition of the vine; but the most common cause is imperfect pollination due to impotent pollen.

"Lists are given of varieties, both strongly self-fertile and imperfectly self-fertile or self-sterile, which blossom very early, medium early, in mid-season, medium late, late, and very late."

Bench grafting resistant vines, F. T. BIOLETTI and A. M. DAL PIAZ (*California Sta. Bul. 127, pp. 38, figs. 10*).—The gradual spread of the phylloxera in California vineyards, necessitating their reestablishment on resistant roots, has led the authors to carry out extensive investigations as to the most suitable varieties for this purpose, the best methods of grafting the same, and the grafting of vinifera varieties upon various resistant stocks. Cuttings imported from France were so damaged during transportation as to make desirable the use of only California-grown cuttings in the experiments.

The 3 most resistant stocks used in 1898 were Riparia Gloire de Montpellier, R. grande glabre, and Rupestris St. George. Twelve vinifera varieties grew well and made good unions on the first, 14 on the second, and 13 on the third. Brief detailed notes on the growth in 1899 of each of these varieties are given, as well as of the growth of some other varieties and of certain crosses of Rupestris on its own roots.

In 1899 the experiments consisted chiefly of tests of methods of grafting and of planting in the nursery. Ten varieties of American grapes were used as stocks, the varieties Zinfandel, Mondeuse, Tokay, and Ferrara as scions, and 3 varieties for rooting experiments.

The proportion of successful unions obtained by the different methods of grafting and with the different stocks is shown in the following tabular summary.

Tabular review of grafting experiments.

Nature of experiment.	Proportion of unions. First class.	Proportion of unions. Second class.	Remarks.
	Per cent.	*Per cent.*	
Champin grafts	11	11	
English cleft grafts	37	6	Unions very complete.
Scions with two eyes	46	13	
Scions with one eye	38	7	
Grafts callused in sand	61	7	
Grafts callused in straw	46	12	Unions weak.
Grafts not callused	26	13	Growth rather short.
Zinfandel on Rupestris St. George	64	11	Good growth.
Mondeuse on Rupestris St. George	54	10	Do.
Ferrara on Rupestris St. George	75	9	Very strong growth.
Tokay on Rupestris St. George	60	6	Strong growth.
Rupestris St. George as stock	64	11	
Riparia Gloire de Montpellier as stock	15	12	Do.
Herbemont	0	0	
Lenoir	1	2	
Cunningham	7	4	
American Rulander	0	0	
Munson, rooted vines	69	0	Good growth.
America, rooted vines	0	30	
Champini, rooted vines	0	0	
Elvicand, rooted vines	0	0	

"The figures in the above table must not be taken as representing the exact relative values of the various methods and varieties compared, but . . . may be considered as valuable indications."

Relative to the influence of the scions on the growth of the grafts, the authors state as follows:

"The Mondeuse, though quite satisfactory, gave a smaller percentage of successful grafts than any of the others. They started later than the Zinfandel, and, though the growth and root system were somewhat stronger, the wood was not quite so well matured. The Zinfandel did very well, giving 64 per cent of good grafts and making good growth. The black Ferrara, however, made almost phenomenal growth and yielded 75 per cent of first-class unions. The growth of the Tokay was almost equal to that of the Ferrara, but the number of successful grafts rather less—60 per cent."

The harmful results following neglect in cutting the raffia or other binding material or not trimming away the roots put out by the scions is illustrated by photographic reproductions of several deformed specimens.

The experiments in rooting 580 cuttings of Rupestris St. George, 40 of Riparia Gloire de Montpellier, and 45 of Solonis resulted in 83 per cent of well-rooted vines in the first instance and 80 in the second. Botanical descriptions are given of these 3 most promising resistant stocks for use in California, and the difference in character of their root systems is illustrated.

Some of the conclusions of the authors relative to the results of the whole work are as follows:

"A cutting graft of suitable varieties makes as large and vigorous growth as a simple cutting, so that by the method of bench grafting no time is lost in establishing a resistant vineyard.

"Resistant varieties which are difficult to root but easy to graft when old, such as Lenoir, should not be bench grafted.

"Care in callusing, planting, and treatment in nursery, and especially in keeping

the grafts moist from the time they are made till they are in the callusing bed, will enable even an inexperienced grafter to obtain at least 60 per cent of good, grafted plants.

"Callusing in sand insures more perfect unions and a larger percentage of successful grafts than planting directly in the nursery.

"The moisture in the callusing bed should not be excessive, and the temperature should be relatively warm.

"The growing grafts should be watched closely in order to see that the roots of the scions are removed before they become large, and that the raffia is cut before it strangles the graft.

"The English cleft graft is preferable to the Champin graft, because it gives more perfect unions and can be made with more accuracy and rapidity.

"Scions of two eyes are preferable to those of one eye, as they give more chances of success.

"Rupestris St. George seems to be remarkably adapted to California soils (except the heaviest clays) and conditions, and is to be preferred to any variety yet tested here wherever deep penetration of roots is possible and desirable.

"All the eyes of the Rupestris stock should be cut out deeply and carefully.

"A vigorous and large-growing vinifera scion promotes an equally vigorous and large growth of Rupestris St. George used as stock."

The forcing of plants by ether, J. FISCHER (*Amer. Gard., 21 (1900), Nos. 283, pp. 358–360, figs. 4; 284, pp. 372, 373*).—According to the author, the resting period of a plant when growth is almost or entirely discontinued should be distinguished from the "forced inactivity" of a plant which results from surrounding conditions, as extreme cold or lack of moisture, which make growth impossible. The effects of ether vapor in stimulating into early growth and bloom may find a profitable application in the former condition, while in the latter it is without appreciable effect. The resting period of plants is divided into 3 stages—early rest, middle rest, and after rest, corresponding to decrease in growth, complete rest, and increasing activity, respectively. With the lilac the winter buds are said to be in early rest until midsummer, then in middle rest until the end of October. From the end of October until the end of December or first of January they are in the after-rest stage, "when all of the buds emerge from the resting condition and are held in a condition of forced inactivity by the cold season." During the stages of early and middle rest the stimulating influence of ether vapor is very small and practically without value. It is during the stage of after rest that its use is most effective.

According to the author, the treatment with ether must always be given plants which have not lost or are losing their leaves. "In general it is only in the after-resting stage that etherization is of practical value. Exact dates for the earliest forcing of different species can not be given because the differences due to the season, variety, and method of culture are so great. In general it may be said that the ether method makes it possible to force shrubs 3 to 6 weeks earlier than by ordinary methods of culture."

The author's experiments with Tulip La Reine showed a gain in earliness of from 8 to 12 days due to etherization. Etherized tulips

did not hold the blooms so well. Good results were obtained in the open-air forcing of several varieties of lilacs, *Prunus triloba*, and Viburnum. "No practical results have been reached in the etherization of bulbs before the formation of the roots. It seems to be dependent upon the fact that these structures, if etherized before the roots are formed, are retarded." The beech was considerably retarded in its development by etherization. After the resting period, etherization seems to have no influence upon the development except perhaps to slightly hinder the growth of the shoots. As to the effect of etherization on the color of the flowers, the author states that with lilacs the color was weaker than in untreated specimens. With an exposure of only 24 hours to the ether, the growth was not so rapid and the color deeper.

"To develop strong colors, the plants [lilacs] should be placed in temperatures of 50 to 54° F. Very beautifully colored flowers have been produced at higher temperatures on Andenken and Louis Späth. . . . Splendidly developed flowers, pure white, on Marly Rouge have been obtained by growing etherized specimens of the plant at 62 to 72° F. in full light. Specimens of the same developed later without etherization but under the same conditions otherwise produced sparing bunches of reddish-gray flowers."

Details are given for constructing apparatus in which plants may be etherized and specific directions given for etherizing lilacs, azaleas, *Viburnum opulus*, Amygdalaceæ, Spiræa, *Pyrus floribunda*, *Staphylea colchica*, *Deutzia gracilis*, lily of the valley, and tulips. The summarized directions of the author regarding etherization of plants are as follows: Use only sulphuric ether. The etherizing apparatus should consist of a chamber lined with tinfoil or made vapor-proof in some other manner, with a vessel in the upper part from which ether may be evaporated. The room temperature should be 62 to 66° F. in the daytime, and may be allowed to drop to 58° F. at night. Plants should be exposed to ether vapor 48 hours altogether; or, exposure 48 hours, ventilation 48 hours, and exposure again for 48 hours. For shrubs the amount used should be $1\frac{1}{4}$ oz. of ether for each 40 gal. of air in the chamber. At the close of the exposure to ether, the plants should be brought into a warm room. Etherized plants require less heat for their development than plants not so treated.

Report of the section of botany and horticulture, C. S. CRANDALL (*Colorado Sta. Rpt. 1899, pp. 32–34*).—A brief report is given of the effect of the severe freeze of the winter of 1898–99 on the plum and apple orchards. Of 152 varieties of plums in the station orchard none escaped injury entirely and 30 were killed, as follows: Chickasaw, 5; Beach plum, 1; Wild Goose, 6; Domestica, 6; Japanese, 7; Americana, 4; Hybrid, 1. Individual trees of 44 varieties produced some bloom, of which 37 were Americanas; 5 belonged to the Miner group; 2 were unclassified hybrids; and 1 was *Prunus besseyi*. The young apple orchard suffered even greater loss than did the plum orchard.

Report of the horticulturist, A. B. MCKAY (*Mississippi Sta. Rpt. 1899, pp. 16–21*).—The station irrigation plant is briefly described and an account given of the small and orchard fruits recently planted at the station, with notes on their care.

Report of the horticulturist, C. B. WALDRON (*North Dakota Sta. Rpt. 1899, pp. 47–51*).—This report reviews in outline the work of the year and notes the varieties of garden vegetables which succeeded best. The white ash, which has been recommended as one of the most promising trees for groves and timber belts in the State, was subject to serious attacks during the year from borers and bark beetles that appeared in such numbers as to destroy or cripple nearly all the trees. It is thought from the present outlook that continued plantings of this tree must be abandoned.

In the fields the Rocky Mountain locust and Hessian fly were the most serious insect pests of the year. Some notes are given regarding their control.

The chayote, E. ANDRÉ (*Rev. Hort., 72 (1900), No. 15, pp. 420, 421, pl. 1*).—This tropical fruit or vegetable (*Sechium edule*) is illustrated and described and suggestions given regarding its culture and uses.

Cultivation of pepper in Bombay, J. W. WOLLISON (*Agr. Ledger, 1900, No. 3 (Veg. Prod. ser. No. 48), pp. 23–26*).—Methods of growing and harvesting the black pepper of commerce.

The apple and how to grow it, G. B. BRACKETT (*U. S. Dept. Agr., Farmers' Bul. 113, pp. 32, figs. 10*).—This bulletin is intended primarily for "the guidance of the farmer in the propagation, cultivation, and care of the family orchard." Lists of varieties of apples suitable for culture in different sections of the country are given, and these lists include many commercial varieties suitable for the same districts. Utilization of orchard fruits and the gathering and disposing of the crop are also discussed.

Apples in North Carolina (*Bul. North Carolina State Bd. Agr., 21 (1900), No. 7, pp. 40, pls. 4, figs. 19*).—Popular directions for the culture of apples in North Carolina, with suggestions regarding the most suitable varieties for different purposes and descriptions of some 60 varieties. Papers on the advancement of apple culture in the western part of the State, on the care in handling winter apples, preparing apples for the market, and on the diseases and insects affecting apple trees in North Carolina form the concluding portion of the bulletin.

The apples of France; planting and cultivation, manufacture of cider and apple brandy, fruit production, E. GAUTIER (*Les pommiers de France; plantations et cultures, fabrication du cidre et des eaux-de vie de cidre, production fruitiere. Paris: E. Brocherioux, 1899, pp. 87, pl. 1, figs. 10*).

Orchard technique: III. Growing the apple orchard, W. B. ALWOOD (*Virginia Sta. Bul. 99, pp. 53–79, figs. 12*).—Detailed popular directions for laying out the orchard, selecting nursery stock, planting trees, pruning, cultivating, etc.

Time of pruning affecting time of ripening apricots, J. W. MILLS (*Pacific Rural Press, 60 (1900), No. 5, p. 69*).—The author pruned experimentally 12 varieties of apricots. One-half of each variety was pruned in July after the fruit was taken off and the other half late in December. The late pruning considerably retarded the ripening period of the apricots, the last picking of the July-pruned trees being taken off before the first picking of the December-pruned trees was ripe. This prolonging of the picking season is considered an important factor in securing the crop without loss.

Varieties of sour cherries, U. P. HEDRICK (*Utah Sta. Bul. 64, pp. 43–49, fig. 1*).—The author discusses the possibility and profits of sour-cherry culture in Utah and describes 23 varieties growing at the station. A table is given showing the yields in pounds and marketing period of the same varieties for the 2 years 1898 and 1899. Small plantings of sour cherries throughout the State are urged. Brusseler Braune, Carnation, Ostheim, and Sklanka are among the best varieties growing at the station.

Cherries in the West (*Amer. Gard., 21 (1900), No. 293, p. 520*).—From remarks made at the Nurseryman's Association it would seem that the Early Richmond, Dyehouse, and Montmorency were the most satisfactory varieties to grow in the West.

Cultivation of citrus fruits, E. ARNO (*La coltivazione degli agrumi. Palermo: Alberto Reber, 1899, pp. 447, figs. 36*).—The botany of citrus fruits, chemical analysis of constituent parts, favorable topographic and climatic conditions for growth, cul-

ture, fertilizing, injurious pests, and the economy in growing citrus fruits are discussed.

Fruit culture in Queensland—citrus culture, A. H. Benson (*Queensland Agr. Jour., 7 (1900), No. 1, pp. 34–39*).—Popular directions regarding the cultivation and manuring of citrus trees and on handling and packing the fruit.

Citrus regions of California, B. M. Lelong (*Pacific Rural Press, 60 (1900), No. 6, p. 84*).—A popular discussion of the orange and lemon lands and the conditions of their culture.

Culture of the date palm (*Agr. Jour. Cape Good Hope, 16 (1900), No. 12, pp. 742–744*).—From investigations by the Cape Colony Department of Agriculture it seems that a considerable number of these trees are now growing in Damaraland and Namaqualand and the fruit forms no inconsiderable proportion of the food of the poorer classes. In Damaraland the date palm is successfully cultivated at elevations of 3,000 to 3,500 ft. Above this height it is uncertain. Some information as to the culture and habits of the date palm is included in the article.

Coffee culture in Queensland, H. Newport (*Queensland Agr. Jour., 7 (1900), No. 1, pp. 45–50, pls. 4*).—Pulping and curing are the operations considered. Buildings and machinery for these operations and details of manipulation are given.

Coffee and india-rubber culture in Mexico, preceded by geographical and statistical notes on Mexico, M. Romero (*New York: G. P. Putnam's Sons, 1898, pp. 417*).

Strawberries, C. S. Crandall and C. H. Potter (*Colorado Sta. Bul. 53, pp. 27*).—Detailed popular directions for the culture, fertilizing, irrigation, selection, and pollinating of strawberries, with descriptive notes on 74 varieties and a table showing the comparative size, vigor, productiveness, etc., of the different varieties.

Strawberry trials (*Amer. Gard., 21 (1900), No. 290, p. 469, fig. 1*).—A report is here given on the test of varieties of strawberries grown at the trial grounds of *American Gardening* in 1900. Some 18 of the better varieties are noted in detail.

Food for strawberries, A. H. Ward (*Amer. Gard., 21 (1900), No. 294, p. 535*).—Manuring strawberries is considered. Rotten leaves, decayed wood, and fermented peat ash in small quantities mixed with other vegetable substances are thought to make a better compost for strawberries than animal manures. Nitrate of soda and powdered phosphate of lime are also recommended, about 400 lbs. of the mixture per acre being used.

Strawberry breeding, N. O. Booth (*Amer. Gard., 21 (1900), No. 294, pp. 534, 535*).—Methods of breeding strawberries are given and the objects to be sought noted. Some results secured at the Missouri and New York State experiment stations in breeding strawberries are given. Usually less than 1 desirable seedling can be expected out of each 1,000 seedlings grown. In Missouri the varieties Warfield No. 2, Lady Rusk, Crescent, and Bubach No. 5 gave seedlings about 5 per cent of which were considered worth saving beyond the first fruiting year. Crescent × Sharpless has given a high percentage of good seedlings both in Missouri and New York.

The Oregon evergreen blackberry, U. P. Hedrick (*Utah Sta. Bul. 64, pp. 50–54, fig. 1*).—Notes on the yields and characteristics of the Oregon evergreen blackberry, with replies to letters of inquiry of 8 nurserymen regarding its origin, history, qualities, cultivation, possibilities, etc.

Grapes for calcareous soils, F. Lavoux (*Messager Agr., 5. ser., 1 (1900), No. 5, pp. 187–191*).—As a result of tests on the experimental grounds at Charentes, lists of varieties suitable for growing on light, dry, humid, and heavy soils, containing various amounts of lime, are given.

Observations on the phenology and maturity of cultivated vines, Bonnet and Vidal (*Ann. École Nat. Agr. Montpellier, 11 (1899–1900), pp. 329–359*).—The phenology and date of maturity of about 500 varieties of cultivated grapes growing at the National Agricultural School grounds at Montpellier are recorded for the sea-

son of 1899. A difference of 34 days was observed between the earliest and latest varieties starting into growth, when all varieties were considered. With French varieties alone a difference of 22 days was observed.

What grapes are best as pollenizers, F. H. HALL and S. A. BEACH (*New York State Sta. Bul. 169, popular ed., pp. 5*).—This is a popular edition of Bulletin 169 of the station (see p. 240).

Systems of grape pruning in the Mediterranean region, L. RAVAZ (*Ann. École Nat. Agr. Montpellier, 11 (1899–1900), pp. 315–328*).—After considering comparatively and physiologically a number of different systems of grape pruning, the author believes that with the vines, soils, and climate of the Mediterranean region the older method of short pruning on low stocks is to be preferred to later methods of long pruning, since more wine of a better quality is obtained.

On the quantity and quality of the products of the vine, L. RAVAZ (*Ann. École Nat. Agr. Montpellier, 11 (1899–1900), pp. 329–333*).—Theoretical considerations on increasing the quantity while maintaining the quality of vine products.

The growing of herbaceous Calceolaris, W. KLEINHEINZ (*Amer. Gard., 21 (1900), No. 289, pp. 455, 456, fig. 1*).—Cultural directions.

The clematis (*Amer. Gard., 21 (1900), No. 293, p. 521*).—Historical and cultural notes, with remarks on hybridizing and on diseases and insects.

How to grow lilies, J. McGREGOR (*Amer. Gard., 21 (1900), No. 292, p. 504*).—Short paper covering time of potting the bulbs, removal to the house, temperature, etc., read by the author before the Pennsylvania Horticultural Society.

The history of the rose (*Jour. Hort., 52 (1900), Nos. 2697, p. 478; 2702, p. 34; 2706, p. 132*).—The early history is dealt with especially.

Chronological contributions to the history of the sweet pea (*Amer. Gard., 21 (1900), No. 292, p. 501*).—Historical notes on the sweet pea, beginning with its introduction into England from Italy in 1696 and coming up to the present.

Nicholson's dictionary of gardening. Supplement, G. NICHOLSON (*Hyde Park, Mass.: G. T. King, 1900, pp. 376, figs. 385*).—This work supplements the author's dictionary of gardening, bringing the matter up to date as far the letters A–F.

FORESTRY.

The density of forest crops, W. SCHLICH (*Gard. Chron., 3. ser., 27 (1900), No. 705, pp. 414–416*).—The author undertakes to answer the question as to the proper density of forest crops at which the fertility of the soil is preserved, if not increased, and the most valuable class of timber produced. The results of thousands of measurements are given of Norway spruce, beech, oak, and Scotch pine, in which all kinds of soils are considered. The average results are given in the following table:

Density of forest crops.

Age of wood.	Number of trees to the acre.			
	Norway spruce.	Beech.	Oak.	Scotch pine.
20 years	2,800	2,800	2,700	1,900
30 years	2,000	1,790	1,140	1,250
40 years	1,380	1,150	640	850
50 years	1,020	770	420	620
60 years	660	560	310	460
70 years	490	440	240	360
80 years	400	330	200	290
90 years	330	260	160	240
100 years	290	220	140	200
110 years	260	190	120	180
120 years	250	160	105	160

Experiments in forestry, C. S. Crandall (*Colorado Sta. Rpt. 1899, pp. 34, 35*).—The station has continued experiments in forestry started in cooperation with the Division of Forestry of this Department in 1896. On one of the forest plats nearly 4,000 plants of southernwood (*Artemisia abrotanum*) were planted as nurse plants for conifers. The plants are said to have covered the ground completely and to serve well as a protection for other plants, but to be of no other use, as they kill to the ground each winter.

Some local conditions of forestry in England (*Jour. Bd. Agr.* [*London*], *7* (*1900*), *No. 1, pp. 1–9*).—Notes are given on the distribution and growth in England and Wales of a number of the more common forest trees, the diseases and injuries to which they are subject, and market conditions.

Report of the Bureau of Forestry, T. Southworth (*Rpt. Clerk Forestry, Ontario, 1899, pp. 144, pls. 8*).—Notes are given on forestry methods, forest reserves, windbreaks, shelter plantings, street tree planting, etc. A compilation and history is given of the Crown timber regulations to the present time.

Forest law in the United States, T. Cleveland, Jr. (*Forester, 6* (*1900*), *No. 7, pp. 153–160*).—The topics discussed in this paper are: Forest law in general, early settlers and the forests, beginnings of a Federal forest policy, the Federal land policy, and timber culture laws.

Railroad forestry, J. H. Sutor (*Sci. Amer. Sup., 50* (*1900*), *No. 1286, pp. 20619, 20620*).—An address delivered before the Central Association of Railroad Officers in which reforestation is strenuously urged.

Notes on the forest trees of Ohio, W. R. Lazenby (*Jour. Columbus Hort. Soc., 15* (*1900*), *No. 1, pp. 26–29, pls. 3*).—Notes are given on the forest trees which are found growing wild in the State of Ohio. The number is said to be at least 112 species, representing 25 orders and about 50 genera.

Observations on the Eucalyptus of New South Wales, V and VI, H. Deane and J. H. Maiden (*Proc. Linn. Soc. New South Wales, 1899, Nos. 3, pp. 448–471, pls. 6; 4, pp. 612–630, pls. 3*).—Descriptions are given of a number of species and varieties of Eucalyptus. Notes are also given on their economic value.

The lebbek or siris tree, D. G. Fairchild (*U. S. Dept. Agr., Division of Botany Circ. 23, pp. 4, figs. 2*).—A history and description of this tree imported from India and as found in Egypt. It grows rapidly in the latter country in a sandy soil with little moisture. The wood is durable, works well, and is of value. It is mainly desirable as a shade tree for avenues and is recommended for southern California, Arizona, and Florida.

SEEDS—WEEDS.

Investigations on weeds, H. L. Bolley (*North Dakota Sta. Rpt. 1899, pp. 25–28*).—A brief report is given of experiments conducted in weed destruction, in which marked success was obtained when copper sulphate was sprayed over the field at the rate of 1 lb. of copper sulphate to 4 gal. of water, the solution being used at the rate of 40 to 50 gal. per acre.

The author has begun an investigation of weed seeds planted at different depths, in which the seeds of a number of the more common weeds were planted at depths varying from 1 to 10 in.

Studies have been made at various elevators and mills throughout the State to determine what influence they may have as weed distributers. It was found that the following weed seeds occur quite abundantly in wheat and are responsible for considerable loss not only in

the reduction of yield, but in depreciation of the quality: *Ambrosia trifida*, *Lychnis githago*, *Saponaria vaccaria*, *Polygonum convolvulus*, *Setaria viridis*, *S. glauca*, and *Avena fatua*.

Killing weeds with chemicals, L. R. JONES and W. A. ORTON (*Vermont Sta. Rpt. 1899, pp. 182–188*).—Since the publication of the bulletin on the use of salt in killing the hawkweed (E. S. R., 8, p. 987), the authors have received many inquiries as to the possibility of destroying other weeds by chemicals, which led them to make a comparative test of a number of chemicals for this purpose. Among those included were common salt, copper sulphate, potassium sulphid, kerosene, arseniate of soda, a mixture of white arsenic and sal soda, and 2 proprietary articles. These chemicals were tested by marking off areas on gravelly walks, roadways, tennis courts, and similar dry, beaten soils. Applications were begun about July 1 and observations continued until autumn. The different chemicals were tried at the rate of about 8 gal. of solution to each square rod of surface. The weeds most commonly present were knotweed (*Polygonum aviculare*), white clover, various grasses, purslane, plantain, dandelion, etc. Of these the knotweed was most troublesome and the efficiency of the chemicals in destroying this weed was considered the best gauge of its value. The experiments with different chemicals are reported at some length, together with notes on their cost, and the following conclusions were drawn:

"Gravel walks, drives, tennis courts, and similar places can be kept free from weeds by the use of certain chemicals.

"Common salt can be used for this purpose, but very heavy applications are required, and when used in such amounts it is liable to be washed into the borders of adjacent lawns. Salt should always be applied in the dry form. The weeds may be more fully suppressed without such danger from washing by certain other chemicals. These are to be applied in solutions, and at the rate of about 8 gal. to the square rod.

"Crude carbolic acid is a very powerful and quick acting herbicide. One pint in 4 gal. of water is usually sufficient; cost as diluted, ½ ct. for a gallon, 4 cts. to the square rod. Its effects are not as enduring, however, as are those of the arsenical solutions.

"Various arsenical compounds are available, including arseniate of soda, a mixture of white arsenic and sal soda, and two proprietary articles. The choice between these latter becomes largely a matter of relative expense and convenience. In general, the choice should, in our judgment, lie between the crude carbolic acid and the arseniate of soda.

"One or at most two applications each season of one or another of these chemicals will, it is believed, suffice to keep down the weeds."

The use of solutions of sulphate of ammonia and superphosphate for destroying weeds, MAIZIÈRES (*L'Engrais, 14 (1899), No. 36, pp. 851, 852*).—The author quotes from a report of experiments made by M. Georges Castel-Delétrez in eradicating weeds by spraying with solutions of sulphate of ammonia. A 3 per cent solution burnt

the edges of the leaves of plumeless thistles (Carduus), but did not appear permanently to injure the plant. A 5 per cent solution destroyed some whole leaves and checked growth for several days. A 10 per cent solution entirely destroyed young plants. A 15 per cent solution applied to plants 20 to 30 cm. in height entirely destroyed a part of them. In experiments with white mustard, a 10 per cent solution completely destroyed the plants in those cases in which application was made before the flower buds were developed. If applied later, it was not effective.

The author then proceeds to report very briefly on some experiments made by himself along this line, using, however, in this case a solution of superphosphate. Details of the experiments are not given, but it is said that very satisfactory results were reached in experiments with various cruciferous plants. The experiments were repeated with mixed solutions of superphosphate and sulphate of ammonia, and in this case a solution of 5 degrees of density proved very efficient. The experiments are to be continued.

Results of experiments on the spraying of charlock, P. H. FOULKES (*Jour. Reading Col., England, Sup. 9, pp. 55–59*).—Spraying experiments were conducted in 6 localities, in which copper sulphate in strengths of 2 to 6 per cent and quantities of 25 to 75 gal. per acre was tested. The applications were made under different climatic conditions on wheat, barley, and oats at different stages of growth, when the charlock plants were quite young, just before flowering, and while in flower. On the whole, the experiments were considered to establish the value of copper sulphate as a means of destruction of charlock. For the best effect of spraying the author considers the following conditions necessary: A clear, still, dry day, the application of a 2 per cent solution at the rate of 50 gal. per acre before the charlock comes into flower, and the thorough application of the spray, in which the nozzle should be held low so that the spray may fall upon and not be driven against the plants. If these conditions are complied with, it is thought that one spraying will be sufficient to destroy the weeds. If rain falls within 24 hours after the spraying, it is advised that the application be repeated.

Spraying of charlock (*Jour. Bd. Agr. [London], 7 (1900), No. 1, pp. 43–45*).—A brief report is given of experiments conducted in north Wales in regions which are notably infested with this weed, in which one-eighth-acre plats were sprayed with copper sulphate, and comparisons made with other plats sprayed with iron sulphate. Iron sulphate failed to produce any appreciable effect upon the weeds, while copper sulphate gave better results although not altogether satisfactory ones. The sprayings were probably made too late in the season, as the results seem to indicate that the advantage of spraying depends largely on the age of the charlock at the time of spraying. No injury to the

crop sprayed was noted. In one series of experiments the plant proved to be the "smooth-leaved charlock," and upon this the solutions seemed to have no effect.

Eradication of moss in pastures (*Jour. Bd. Agr.* [*London*], *7* (*1900*), *No. 1, pp. 39, 40*).—An account is given of a number of experiments for the eradication of moss in pasture lands. None of the usual reasons assigned for the presence of moss, such as sourness of soil, deficient aeration, or great poverty of the soil were present, the experiments being conducted on light loamy soils which rested on chalk. Chemical and mechanical means were investigated. The chemicals used were sulphuric acid, lime, superphosphate, basic slag, salt, and iron sulphate. The mechanical methods tested were lifting the turf, rolling, and raking. The chemical treatment seemed to have little or no effect, while of the mechanical processes rolling was most effective.

The farmer's interest in good seed, A. J. PIETERS (*U. S. Dept. Agr., Farmers' Bul. 111, pp. 24, figs. 7*).—A popular bulletin on the value of seed testing, in which the relationship between quality of seed and amount sown, methods of seed testing, etc., are described. The results of tests with a number of samples of red clover, redtop, Kentucky blue grass, timothy, orchard grass, smooth brome grass, and crimson clover are given, in which the market price and actual value of seed are shown. In many instances the actual value of the seed, as shown by tests, was decidedly less than the market price paid.

Red clover seed, A. J. PIETERS (*U. S. Dept. Agr., Division of Botany Circ. 24, pp. 5, figs. 2*).—Red clover seed is described, together with a number of its more common adulterants and impurities. The value of testing seed is pointed out and in general it is found that high-grade medium-priced samples are in reality the cheapest.

The seed of smooth brome grass, A. J. PIETERS (*U. S. Dept. Agr., Division of Botany Circ. 25, pp. 5, fig. 1*).—The rapid introduction of this grass in the arid and semi-arid regions of this country has led to many inquiries concerning it, and the author describes popularly the seed and some of the impurities associated with it. Directions are given for sampling and testing brome-grass seed, and the offer is made by the Department to test such seed for those desiring it.

Resistance of seeds to heat, SCHRIBAUX ET AL. (*Messager Agr., 5. ser., 1* (*1900*), *No. 6, pp. 227, 228*).—All cereals except maize are said to readily withstand temperatures of 100° C. for short periods. Wheat heated for 1 hour to 105° C. germinated 97 per cent; 115°, 95 per cent; 116°, 93 per cent; 120°, 56 per cent; and 125°, 4 per cent.

The resistance of seeds to high temperatures, V. ROGER (*Messager Agr., 5. ser., 1* (*1900*), *No. 5, pp. 191, 192*).—Peas and cress heated to 60° C. for 24 hours and then to 98° for 10 hours gave 30 and 60 per cent germinations, respectively. Heated directly to 98° all were killed. Cress seed germinated after 800 hours in a thermostat at 65° C. Peas and cress in sealed tubes with quicklime retained their power of germination after an exposure of 206 days at 40° C.

Method for determining the relative value of beet seed, G. LINHART (*Kisérlet. Köslem., 3* (*1900*), *No. 2, pp. 136–139*).

Annual report of Danish seed control station, 1896–97, O. ROSTRUP (*Tidsskr. Landbr. Planteavl, 5* (*1899*), *pp. 1–38*).—The report gives the usual account of the results of seed analyses made during the year, with summary tables for the years 1887–1897, inclusive, and such other discussions as the work during the year has suggested. There were received for examination during 1896–97 1,762 seed samples,

of which 1,184 were subjected to complete analyses, 243 to determinations of purity, and 310 to determinations of germination. Of the samples 934 were sent by seedsmen, 69 by seed growers, and 508 by farmers, the rest being secured for original investigations. An investigation as to the influence of concentrated sulphuric acid on hard seeds of legumes showed that the germination of flat pea was greatly improved by steeping the seeds in acid for one minute; after 60 days the germination of the treated seed was 84 per cent, and that of the untreated seed 28 per cent. After 300 days all the treated seed had germinated, while those not treated showed a germination of 76 per cent. It is likely that a longer treatment with sulphuric acid will further improve the germination of flat pea. A sample of red-clover seed left in concentrated sulphuric acid for 24 hours still contained 9 per cent of viable seed.—F. W. WOLL.

Report of the Danish seed control station, 1897–98, O. ROSTRUP (*Tidsskr. Landbr. Planteavl, 6 (1900), pp. 1–37*).

Report of the Danish seed control station for the year 1898–99, O. ROSTRUP (*Tidsskr. Landbr. Planteavl, 6 (1900), pp. 113–169*).—Contains the usual compilation of the results of seed analyses made during the year, and during the decennium 1889–1899. Of other subjects treated in the report may be mentioned: List of seeds of wild or cultivated plants found in seed samples of cultivated plants sent to the Danish seed control station (pp. 135–154); on the decrease in viability of seeds from spring to fall (pp. 156–158); germination trials of seeds of wild plants (pp. 158–169); germination trials with cacti (p. 169).—F. W. WOLL.

Twenty-seventh report of Markfrökontoret (seed office) (*Copenhagen, 1899, pp. 32*).—The report contains the usual account of the work of the office, and a number of papers on the culture of different agricultural crops.

Reports of Swedish seed control stations for 1898 (*Meddel. K. Landtbr. Styr., 1900, No. 63, pp. 401–465*).—Eighteen stations, in part supported by Government, were maintained during the year; 8,258 seed samples were examined at these stations during 1898, 6,147 complete analyses having been made, and 2,111 partial analyses. Farmers sent in 3,161 samples, seedsmen 4,455 samples, and 638 samples were secured by the stations themselves in special investigations; 19.6, 12.2, and 11.6 per cent of the samples received for examination were analyzed at the seed control stations at Lund, Stockholm, and Oerebro, respectively. The average results of the analyses for each kind of seed and for each station, with ranges of results, are given in the report.—F. W. WOLL.

Report of the seed control station at Lund, Sweden, for 1899, B. JÖNSSON (*Malmö, 1900, pp. 20*).

Report of the seed control station at Gothenburg, Sweden, for 1898–99 J. E. ALÉN (*Göteborg, 1900, pp. 14*).

Report of the Skara seed control station for 1898–99, S. HAMMAR (*Ber. Verks. Skara Kem. Sta. och Frökontrollanst., 1899, pp. 25–31*).—A report is given of the analyses of 149 lots of seed which were tested between July 1, 1898, and June 30, 1899. Of these rye, red clover, alsike clover, and timothy seed constituted 75 per cent of the samples.

Some common Ontario weeds, F. C. HARRISON (*Ontario Dept. Agr., Toronto, 1900, pp. 86, figs. 34*).—A popular discussion is given on the introduction and spread of weeds; methods of identification, classification, and eradication. The more common weeds of Ontario to the number of 34 species are figured, popularly described, and suggestions given for their eradication. Based upon replies from correspondents, the author represents graphically the comparative destructiveness of Ontario weeds. Those most troublesome in order of destructiveness are Canada thistle, mustard or charlock, wild oat, couch grass, ragweed, oxeye daisy, false flax, dock, burdock, and foxtail.

Noxious weeds (*Rpt. Dept. Agr. Northwest Territories, 1899, pp. 29–40*).—A report is given of the distribution of a number of troublesome weeds and the activity of the inspectors in enforcing the laws on weed destruction.

On the geographical distribution of some of our weeds, J. HOLMBOE (*Tidsskr. Norske Landbr., 7 (1900), No. 4, pp. 155–171*).

Experiments in weed prevention, J. A. VOELCKER (*Jour. Roy. Agr. Soc. England, 3. ser., 11 (1900), No. 41, pp. 110–115, fig. 1*).—In this pot experiment, 4 series were used: 1, control; 2, sprayed with ammonia liquor from gas works; 3, treated with salt at the rate of 5 cwt. per acre and subsequently sprayed with a 2 per cent solution of sulphate of copper; 4, sprayed with carbolic acid solution. The weeds that appeared were speedwell, groundsel, shepherd's purse, goose foot, and knot grass (*Polygonum aviculare*). Gas liquor used in its full strength, containing 2.93 per cent ammonia, killed all the weeds except goose foot and knot grass. The other chemicals used were found to be practically useless for weed prevention.

Spraying for weed destruction (*Deut. Landw. Presse, 27 (1900), No. 53, p. 679*).—Notes are given on the successful spraying with solutions of iron sulphate for the destruction of field mustard in a number of crops.

Bur medic (*Queensland Agr. Jour., 6 (1900), No. 3, p. 209, pl. 1*).—Notes are given on *Medicago denticulata* which is considered a very troublesome and injurious weed in pastures.

Destruction of charlock (*Jour. Bd. Agr.* [*London*], *6 (1900), No. 4, pp. 465–468*).—Good results will, as a rule, be obtained by spraying charlock when not over 3 in. high with a 4 per cent solution of copper sulphate or a 15 per cent solution of iron sulphate at the rate of 40 gal. per acre. Cloudy days without rain give better results than when spraying is done upon bright days.

The eradication of the prickly pear (*Queensland Agr. Jour., 6 (1900), No. 4, pp. 319, 320, pls. 2*).—An account is given of the successful use of a spraying solution for the destruction of the prickly pear. The composition of the solution is not given.

DISEASES OF PLANTS.

Report of the botanists, G. E. STONE and R. E. SMITH (*Massachusetts Hatch Sta. Rpt. 1899, pp. 56–73*).—The principal investigations of the authors during the season covered by this report have been confined to problems in vegetable physiology and pathology. The presence of a serious disease in asters is reported, and the authors have begun investigations with a view to ascertain the nature of the trouble and the means for its prevention. Bacterial cucumber wilt has made its appearance in the vicinity and caused serious injury to the crop. In the Annual Report of the station for 1897 (E. S. R., 10, p. 648), the authors described a leaf spot of geranium which was thought to be caused by bacteria. At that time it was believed to be the result of abnormal conditions rather than a true disease. However, during the season covered by the report, the disease has been prevalent and has caused a considerable loss. It causes small yellow dull spots in the leaves, so that they soon fall off and the plant becomes nearly denuded. Examination of the dead spots shows they are full of bacteria, but all attempts to isolate the organism have been without success.

Failures of the muskmelon crop are reported due to *Alternaria* sp.

and the common anthracnose (*Colletotrichum lagenarium*). The first disease appeared earlier than before, and spraying experiments for its prevention were too late to be of value. In the case of the anthracnose, applications of Bordeaux mixture begun July 1 or earlier will prevent injury. The maple-leaf blight (*Phyllosticta acericola*), is briefly described. This disease produces large dead spots in the leaves, which become curled and distorted, losing their beauty; but beyond this the actual injury to the tree is considered in most cases slight.

The chrysanthemum rust, which was first reported in 1897 (E. S. R., 10, p. 648), appears to be on the decline. It has appeared in numerous places, but apparently caused little or no damage.

Experiments are reported on growing violets in sterilized soil, the purpose of which was to determine the relation between the production of flowers and the occurrence of leaf spots in sterilized and unsterilized soils. The methods of sterilizing the soil were previously given (E. S. R., 10, p. 1055). The plants for the experiments were made from cuttings started in sterilized sand, afterwards transplanted into sterilized soil and removed out of doors, where they remained during the summer. In the fall they were transplanted into a bed divided into 2 sections, one of which was sterilized and the other not. The yield of flowers from both plats is tabulated, from which it appears there was a gain of 36 per cent in the number of flowers gathered from the sterilized plat over that from the unsterilized one. The observations made to determine the relative amount of leaf spot on the 2 plats showed that the sterilized plats gave the smallest number, indicating the more vigorous plants were grown on the sterilized soil. The authors state that "while there is no doubt as to the beneficial results obtained by sterilizing the same soil for 2 or 3 crops, it does not necessarily follow that the soil will repeatedly stand this treatment and give good crops."

Report on various cryptogamic diseases, E. MARCHAL (*Bul. Agr.* [*Brussels*], *16* (*1900*), *No. 1, pp. 8-21, figs. 8*).—Brief notes are given on a number of diseases of more or less economic importance. Among those described are the white rust of purslane due to *Cystopus portulacæ;* rusts of cereals, in which *Puccinia graminis* is reported on barley, wheat, rye, oats, and numerous grasses, *P. rubigo-vera* on wheat and barley, and *P. coronata* on oats as well as on certain pasture grasses; the vesicular rust of pine needles caused by *Coleosporium senecionis;* stem rust of rye caused by *Urocystis occulta;* Polyporus on fruit trees, the species mentioned being *P. igniarius fulvus;* a rust of pine needles caused by *Lophodermium pinastri;* a browning of spruce needles caused by *L. macrosporum;* a blight of shallots due to *Sclerotinia fuckeliana;* a new Phoma disease of tomatoes, in which serious injury to the fruit is reported in greenhouses; a leaf disease

of the sycamore caused by *Glœosporium nerviseqnum*; and a new disease of medlars caused by *Monilia linhartiana*. The disease of medlars is characterized by the appearance of dark brown dry spots along the midrib and principal veins of the leaves. These increase in size until the entire leaf is invaded. The young fruits are also attacked, turn brown, dry, and fall from the tree.

Smut of cereals, H. L. BOLLEY (*North Dakota Sta. Rpt. 1899, pp. 20-25, fig. 1*).—Since 1895 the author has been investigating the influence of different dates of seeding, soil condition, climate, etc., on the growth of smuts, and in the case of the stinking smut of wheat has drawn the following conclusions: The stinking smut of wheat in the region of the station will grow best if left exposed to the weather in the unbroken smut balls throughout the winter months. For best germination of the spores a condition of soil atmosphere approaching saturation is required, while the presence of actual water in the soil is detrimental. A wide range of temperature for the germination of spores has been observed when the soil conditions are favorable. The best soil conditions for a high percentage of infection in the field would be those which give a good growth of the wheat plant, associated with a saturated soil and a daily temperature showing a minimum of 15 to 35° F. In conducting his test it was found that the millet smut developed best when the ground was too wet to produce a large growth of wheat smut, and it is thought probable that each species of smut will be found to vary in the conditions required for its development.

The use of formaldehyde for grain disinfection has been further investigated with good results. Acting upon the popular belief that chlorid of lime would prove beneficial in preventing smuts of wheat, the author investigated the subject, but found it was without value as a smut preventive.

Potato diseases and their remedies, L. R. JONES and W. A. ORTON (*Vermont Sta. Rpt. 1899, pp. 151-155*).—This report gives an account of observations and experiments made on potato diseases and their control in 1898. The season was somewhat less favorable for the diseases than the preceding one, the principal injury being reported from tip burn, which occurred rather abundantly on potatoes planted in light soils. Plants sprayed with Bordeaux mixture were relatively exempt from attacks of the flea-beetle and showed little evidence of tip burn. In the vicinity of the station there was little injury due to either the early or late blight, although some damage was reported from these causes in other parts of the State.

Spraying experiments were conducted to test the value of standard Bordeaux mixture in which the lime and copper sulphate were each diluted to the proper degree before mixing, an improperly made Bordeaux mixture in which the concentrated solutions were combined and then diluted to the proper strength, and a commercial Bordeaux mix-

ture which is essentially the same as the second mixture just described. The results obtained from a series of 20 plats showing the comparative value of the different forms of Bordeaux mixture were decidedly in favor of the standard mixture. Tests were also made of 2 commercial powders, Bug Death and Laurel Green, as substitutes for Paris green and Bordeaux mixture for use upon potatoes. The primary object was to determine whether these compounds had any value as fungicides, but the absence of all fungi rendered this portion of the experiment of no value. It was found that both the powders possessed considerable value as insecticides, although no comparison can be drawn with Paris green on account of the difference in the experiments.

A new phoma disease of swedes, M. C. Potter (*Jour. Bd. Agr.* [*London*], *6* (*1900*), *No. 4, pp. 448–450, pl. 1, figs. 5*). A description is given of a somewhat common disease of swedes which occurs in the north of England and, according to the author, appears to have been thus far undescribed. When fairly advanced the disease is usually recognized by pale, straw-colored, or brownish patches which contrast strongly with the ordinary color of the root, and by the large dry cracks which sometimes penetrate deeply into the flesh. The natural color of the swede is destroyed and replaced by discolored patches which are surrounded by a narrow border of dark metallic green, shading into a dark purple. Numerous small spots of a deep purplish green color, encircling a central lighter spot, indicates the commencement of the disease. One striking characteristic of the disease is the dry condition of the attacked cells, the cortex usually separating as a dry papery layer. The microscopical appearances of the fungus are described at considerable length and results of cultures are given in which the complete cycle of the fungus was carried out upon swedes. In general appearance the fungus agrees very closely with the description given of *Phoma brassicæ*, which is said to attack cabbages in the west of France. It possesses other characters which have been given for *P. sanguinolenta*, which is said to attack carrots, and the author thinks eventually these different parasites will be found to be forms of the same species.

Suggestions are given for methods of combating the disease. At present the only means seems to be remedial and consists in the destruction of all infested roots and greater attention to storage and fertilizers.

Tomato blight, G. W. Herrick (*Mississippi Sta. Rpt. 1899, pp. 43, 44*). In order to obtain some practical method of dealing with tomato blight, the author conducted a number of experiments during the season covered by the report. Seedlings were grown on infected soil and kept in the greenhouse where similar plants had been grown every year. Equal areas were planted in soils which had produced blighted tomatoes the year previous. One plat was treated with lime at the

rate of 4,000 lbs. per acre; the second plat was left as a check, and the third plat was treated with kainit at the rate of 400 lbs. per acre. The record obtained showed less blighted plants where the lime was employed than on the other plats.

In another experiment 2 plats of the same area were planted with seedlings grown on uninfected soil and in a greenhouse in which no seedlings had been grown. In one of the plats where blighted tomatoes had been grown the previous year, lime at the rate of 4,000 lbs. per acre was added. The other plat received no treatment, and a comparison of the yield of the 2 plats showed but slight difference in the percentage of blighted plants.

Another series of plats were tested the soil of which had never borne tomatoes. The first plat was planted with seedlings grown on infected soil and was treated with kainit at the rate of 400 lbs. per acre. Plat 2 was similarly planted but not treated. The third plat was similar in all respects except it received lime at the rate of 4,000 lbs. per acre. The fourth plat was set with seedlings grown on uninfected soil and treated with lime. In this series of experiments only 1 plant was blighted, and that was found on plat 3. The author states, as a result of his experiments, that "infection is not obtained in the greenhouse and that rotation of the crop is a benefit and probably necessary."

The relationship existing between the asparagus rust and the physical properties of the soil, G. E. STONE and R. E. SMITH (*Massachusetts Hatch Sta. Rpt. 1899, pp. 61-73*).—Attention was previously called by the authors (E. S. R., 11, p. 159) to the probable relationship existing between dry seasons and the occurrence of the summer or injurious stage of the rust. Continued observations have been made on this subject, and with but one exception the authors report that the rust has never been observed by them or reported to them except in soils which were sandy and possessed little water-retaining properties. Mechanical analyses of a number of soils of the State are given with their water-retaining capacity. The conclusion is reached that injury by the summer stage of the asparagus rust is due to a weakened condition of the plants from growing on dry soils during seasons of extreme drought. The practice of spraying for the prevention of the rust is not considered productive of good results. If the development of the rust is due to lack of moisture in the soil, it seems that it will be necessary to resort to soil of finer texture for the cultivation of the crop and the practice of irrigation wherever possible.

Fungus diseases of the roots of fruit trees (*Jour. Bd. Agr.* [*London*], *7* (*1900*), *No. 1, pp. 10-16, pl. 1*).—A number of young fruit trees were submitted to the board of agriculture, and it was found that they were apparently dying from the attacks of a fungus on the roots. The fungus belongs to the genus Rosellinia and threatens to

be a serious pest to various trees. On this account an article by G. Massee on a similar disease of the trees of New Zealand is extensively quoted.

As preventive measures it is suggested that the mycelium, which travels through the soil, may be isolated by digging deep, narrow trenches about the trees, care being taken to throw the excavated soil toward the tree instead of from it. A second method, which has proved of service in France, is to lay the trunk bare as far below the surface of the soil as can be done without injury to the tree and to cover the exposed trunk and soil with sulphur.

The brown spot of the apple, L. R. JONES and W. A. ORTON (*Vermont Sta. Rpt. 1899, pp. 159–164, pl. 1*).—In the Annual Report of this station for 1891 (E. S. R., 4, p. 471), attention was called to a fruit spot of the Baldwin apple which at that time was thought possibly to be due to a fungus which was determined as *Dothidea pomigena*. A re-examination of these brown spots has led to the conclusion that the disease is not primarily due to a fungus. In the past season numerous specimens of Baldwin apples have been examined. Beginning with the first evidences of fruit spot in the autumn before harvest, a careful search was made for bacteria and fungi, neither of which were found. In connection with these observations it was determined that while the spot is the worst in the case of the Baldwins it is also quite common on Northern Spy and was observed on Greenings. The spots are not uniformly distributed over the surface but are more numerous toward the apical portion of the fruit. They are not confined to the surface but appear at various depths, the deep ones often being overlaid by a half inch or more of sound flesh, and are associated in their distribution with that of the vascular bundles occurring at or near the ends of the veins which permeate the flesh of the fruit.

An examination of the literature led the authors to conclude that this disease is the same as that described by Wortmann[1] under the name of "stippen." This work is reviewed at some length and the characters of the disease are summarized. Its occurrence is rather widespread and, while preeminently occurring in the Baldwin apple, more than 30 other varieties are reported as having been attacked to some extent. The greatest damage done by this disease is in the appearance of the fruit, although at times a slight bitter flavor is said to accompany it. The author states the conclusions of Wortmann that the disease is a result of the concentration of the sap following a loss of water. Several factors enter into the problem of spot formation. Among them are the amount and rapidity of transpiration, the kind and relative amount of substances in solution in the sap, the conductivity of the tissues of the fruit, and the specific resistance of the

[1] Landw. Jahrb., 21 (1892), pp. 663–675.

protoplasm of the cells to the injurious action of concentrated sap. Remedies which have been suggested by numerous investigators are cited by the authors, although no experiments seem to have been made by them in controlling the disease.

Spraying for the prevention of apple scab, L. R. JONES and W. A. ORTON (*Vermont Sta. Rpt. 1899, pp. 156–159*).—In continuation of experiments reported in 1898 (E. S. R., 11, p. 356), a block of 5 trees near the middle of the orchard was experimented with, in which Paris green, copper sulphate, and Bordeaux mixture containing Paris green were compared, different rows of trees being sprayed a different number of times. The yield from the different trees is shown, and from the table the importance of early spraying and 1 or 2 applications of Bordeaux mixture after the blossoms have fallen is emphasized. The important point brought out by this investigation is that an apple tree which had not been sprayed in the experiments of 1897 and 1898, but was sprayed during the time of this experiment, bore more scabby apples than all the rest of the orchard where the trees were sprayed. This would indicate the importance of spraying every season and the cumulative effect to be derived from such treatment.

The prevention of peach-leaf curl, W. A. MURRILL (*New York Cornell Sta. Bul. 180, pp. 321–334, dgms. 6*). In Bulletin 164 of this station (E. S. R., 11, p. 164) the appearance and life history of the fungus causing the leaf curl of the peach are described at some length and results of experiments for its prevention are given.

In the present bulletin 2 years' experiments are summarized, which lead to the conclusion that leaf curl of the peach can be readily controlled when proper and timely treatment is given. The orchards selected for the experiments represented a variety of conditions of soil, moisture, and exposure, and were composed of a number of varieties of peaches, some of which were chosen on account of their well-known susceptibility to the disease. The plan of the orchard and outline of investigation for each of the experiments are given in detail.

The trees were sprayed with different strengths of solutions of Bordeaux mixture, potassium sulphid, ammoniacal copper carbonate, copper sulphate, and lime. Of the substances employed as fungicides, Bordeaux mixture proved most useful, and the treatment recommended for peach-leaf curl, based upon these and other experiments, is as follows:

"Spray with Bordeaux consisting of 6 lbs. of copper sulphate, 4 lbs. of good quicklime, and 50 gal. of water about the first of April when the buds are beginning to swell.

"Spray again when the petals have fallen with Bordeaux consisting of 2 lbs. of copper sulphate, 2 lbs. of good quicklime, and 50 gal. of water. If the weather of April and early May is warm and dry this second spraying may be omitted."

Investigations on the brunissure of plants, V. DUCOMET (*Ann. École Nat. Agr. Montpellier, 11 (1899–1900), pp. 171–283, pls. 3, figs. 60*).—An historical review is given of the literature of brunissure and the conclusions of various authors as to its causes are briefly summarized. According to the summary, some authors hold that the disease is due to physiological causes, others to animal or vegetable parasites, while still others claim it is due solely to physical agencies acting upon the cell.

In the authors' investigations particular attention was paid to the brunissure of the grape. The disease, as characterized by the appearance of the different parts of the affected plants, is described at length and the results of a large number of observations and experiments are cited. Differences are noted in the degree of susceptibility of different races and varieties of grapes to this disease and its occurrence and characterization on a large number of other plants are given. The author concludes that brunissure is not of a parasitic nature but is rather due to physiological changes brought about by various causes such as sudden rising and falling of temperature, heavy precipitation, mechanical injuries, and abnormal conditions due to organic parasites.

The disease being due to physiological causes, the author advises attention to the growth and surroundings of the plants as a means for reducing or preventing attacks.

A stunted growth of vines, L. RAVAZ (*Ann École Nat. Agr. Montpellier, 11 (1899–1900), pp. 293–314, pls. 6*).—The author gives a preliminary report upon a peculiar stunted growth of grapevines to which the name *court-noué* is given. The principal characteristics of this disease is a remarkable shortening of the internodes of the vine attacked. The interior of the stem is discolored, being of a brownish-yellow or dark-brown color. The disease is said to be readily transmitted by cuttings and grafts and all affected material should be rejected. Some varieties are more susceptible than others and such should be discarded.

The parasitism of Phoma reniformis, L. RAVAZ and A. BONNET (*Ann. École Nat. Agr. Montpellier, 11 (1899–1900), pp. 284–293, pl. 1*).—The authors review the work of Jackzewsky and Spechnew (E. S. R., 11, p. 1061) and take exceptions to the claim that *Phoma reniformis* is a parasite on the grape. The life history of the fungus is given, and experiments covering almost a year are described in which no evidence of parasitism was observed. The fungus is said to occur rather abundantly as a saprophyte, but is wholly unable to penetrate uninjured tissues. On this account it can not be considered as the primary cause of the very destructive disease of grapes in the Caucasus region.

Two hitherto unknown diseases of Phlox decussata, J. RITZEMA-BOS (*Tijdschr. Plantenziekten, 5 (1899), No. 2, pp. 27–32*).—The attacks

of *Tylenchus devastatrix* upon phlox plants may be recognized by the thicker and shorter stems and irregularly curled leaves of the infested plants. By the shortening of the internodes the leaves are brought close together and produce a characteristic deformity.

In combating this worm it is of considerable importance to cut off and burn all infested parts of the plant above ground, and deep plowing of the soil is also recommended.

The same species of phlox was observed in Brussels and other places to be attacked by a fungus disease which was caused by *Septoria phlogis*. The stems of infested plants remained short, and the leaf petioles were either thickened and shorter than usual or totally undeveloped. In general, the appearance of plants infested with this fungus disease was somewhat similar to that of plants which were attacked by the nematode worm, but the presence of yellowish spots in the case of the fungus disease served to distinguish the 2 diseases. The author recommends that infested plants be cut and burned.

A second partial list of the parasitic fungi of Vermont, L. R. JONES and W. A. ORTON (*Vermont Sta. Rpt. 1899, pp. 164–182*).—In continuation of the previous list noted in E. S. R., 11, p. 356, the authors give corrections of the first list, additional hosts for species there reported, and additional species not listed, together with the host plants bearing the fungi.

Plant diseases in Denmark during 1898, E. ROSTRUP (*Tidsskr. Landbr. Planteavl, 6 (1900), pp. 38–56*).

Cereal rusts with special reference to wheat rusts, G. LINHART (*Kisérlet. Közlem., 3 (1900), No. 2, pp. 140–163, pl. 1, figs. 13*).

Potato scab (*Bul. Bot. Dept. Jamaica, n. ser., 7 (1900), No. 6, pp. 87–92*).—Notes the occurrence of this disease in Jamaica and quotes extensively from bulletins of the Rhode Island Station (E. S. R., 5, p. 590; 7, p. 782; 8, p. 798).

Diseases of beets and beet seed, G. LINHART (*Kisérlet. Közlem., 3 (1900), No. 3, pp. 177–204*).

Diseases of sugar cane (*Rev. Agr. Réunion, 6 (1900), No. 1, pp. 5–11*).—Descriptions are given of a number of diseases of cane due to various causes such as *Tricosphæria sacchari*, *Bacillus vascularum*, *Ustilago sacchari*, *Cercospora vaginæ*, *Dioranotropis vastatrix*, *Collectotrichum falcatum*, etc.

A stem disease of wheat, B. FRANK (*Deut. Landw. Presse, 27 (1900), No. 53, p. 675, pl. 1*).—Descriptive notes are given on *Ophiobolus herpotrichus*, a fungus that has been of serious injury to wheat in a number of German provinces.

Asparagus rust, J. STAPP (*Amer. Gard., 21 (1900), No. 295, p. 550*).—Notes the occurrence of asparagus rust in Illinois.

Notes on a cantaloupe disease, C. S. CRANDALL (*Colorado Sta. Rpt. 1899, p. 36*).—A brief note is given on a cantaloupe disease at Rockyford, where it is said to have done much damage in the season of 1899. A grower is reported to have sprayed small areas with Bordeaux mixture with excellent results.

Cucumber troubles, B. T. GALLOWAY (*Amer. Florist, 15 (1900), No. 627, p. 1382*).—Gives an account of nematodes in cucumber roots and recommends steam sterilization of the soil in the house where the plants were grown as a means of relief.

A disease of cucumber plants, W. G. SMITH (*Gard. Chron., 3. ser., 27 (1900), No. 697, p. 274*).—Describes the damping off of cucumbers which is due to *Pythium debaryanum*. This disease was particularly abundant in greenhouses during the past season. The author thinks its unusual occurrence was due to the cold spring, which

caused longer heating of the houses than usual and less frequent ventilation. As preventive measures he suggests more thorough ventilation and treating the soil with a small quantity of iron or copper sulphate.

Damping off of young cucumbers, E. JENKINS (*Gard. Chron., 3. ser., 27 (1900), No. 700, pp. 324, 325*).—The author agrees with a previous writer that lack of ventilation is a cause of the destructive occurrence of the fungus which causes this disease in forcing houses.

Some diseases of orchard fruits (*Deut. Landw. Presse, 27 (1900), No. 57, pp. 720, 721, fig. 1*).—Notes are given on apple scab due to *Venturia inæqualis* and *Fusicladium dendriticum*, and pear scab caused by *F. pyrinum*.

Some observations on apple-tree anthracnose, A. B. CORDLEY (*Bot. Gaz., 30 (1900), No. 1, pp. 48–58, figs. 12*).—Notes are given on the life history of *Glæosporium malicorticis*, the fungus which is said to be the cause of apple-tree anthracnose in Oregon (E. S. R., 12, p. 58).

The European apple canker in America, W. PADDOCK (*Science, n. ser., 12 (1900), No. 295, pp. 297–299, fig. 1*).—Specimens of diseased apple twigs have been received by the author from Nova Scotia and also from Cortland County, New York, which have been determined by Dr. R. Hartig as infected with the European apple-tree canker (*Nectria ditissima*). It is thought that this is the first record of the disease in America.

A gooseberry and currant disease, G. MASSEE (*Gard. Chron., 3. ser., 27 (1900), No. 698, p. 290, fig. 1*).—This disease which is due to *Plowrightia ribesia* is said to have been rather abundant on gooseberries and currants, where it forms large, wart-like, black bodies, which burst transversly through the bark. A number of successful inoculation experiments were conducted by the author which showed that the organism is one of the wound fungi. As infested branches are invariably killed by it, it is suggested that they should be removed and burned on the first appearance of the disease.

The treatment of mildew and the preparation of copper fungicides, L. DEGRULLY (*Prog. Agr. et Vit. (Éd. L'Est), 21 (1900), No. 19, pp. 549–557, figs. 2*).—Suggestions are given for treating grapes for mildew and formulas and directions for making a number of the more efficient fungicides.

Winter treatment against grape mildew, L. DEGRULLY (*Prog. Agr. et Vit. (Éd. L'Est), 21 (1900), No. 12, pp. 347, 348*).—The proper time for combating mildew is in the spring and summer, winter treatments not giving results commensurate with their cost and labor. Bordeaux mixture, Burgundy mixture, and verdigris are recommended as the fungicides best adapted to the prevention of grape mildew.

Treatment of grape mildew, J. ARTIGALA (*Messager Agr., 5. ser., 1 (1900), No. 6, pp. 218–223*).—Formulas and directions for application are given for a number of fungicides, among them Bordeaux mixture, Burgundy mixture, ammoniacal copper carbonate, verdigris, neutral copper acetate, copper sulphate, corrosive sublimate, potassium permanganate, cadmium sulphate, and solutions containing sugar, resin, etc.

Potassium permanganate for combating grape mildew, C. TRUCHOT (*Prog. Agr. et Vit. (Éd. L'Est), 21 (1900), No. 11, p. 320*).—Notes the successful use of this fungicide against mildew, etc., of the grape.

Coulure of grapes, L. RAVAZ (*Messager Agr., 5. ser., 1 (1900), No. 5, pp. 168–171*).—Under this name the author describes a disease of grapes that seems to be probably identical with that described by Lodeman (E. S. R., 6, p. 732) under the name "shelling" or "rattling" of grapes.

The rusts of florists' plants, B. D. HALSTED (*Amer. Florist, 15 (1900), No. 623, p. 1268*).—Briefly describes the rusts of hollyhocks, carnations, and chrysanthemums.

A natural check for carnation rust, F. H. BLODGETT (*Amer. Florist, 15 (1900), No. 623, p. 1268, figs. 2*).—Gives brief popular notes on the parasite (*Darluca filum*) of carnation rust.

Fairy ring of carnations (*Jour. Hort., 52 (1900), No. 2683, p. 188*).—Notes the occurrence of *Heterosporium echinulatum* on leaves of carnations and recommends spraying or sponging diseased plants with a solution of potassium permanganate.

The clematis disease, J. JENSEN (*Amer. Florist, 15 (1900), No. 625, pp. 1349, 1350*).—A disease caused by nematodes, and methods of prevention.

Diseased iris leaves and roots (*Jour. Hort., 52 (1900), No. 2700, p. 559*).—Notes the occurrence on iris of a fungus similar to if not identical with *Botrytis galanthina*. The leaves are first attacked, later the roots, the plant not surviving the injury. Rotation and fertilization are recommended as remedial treatments. Removing diseased parts of plants and dusting with powdered copper sulphate are also advised.

Diseases of the rose, B. D. HALSTED (*Florists' Exchange, 12 (1900), No. 13, pp. 333, 334, fig. 1; also Amer. Florist, 15 (1900), No. 617, pp. 1033–1037*).—In a paper read before the American Rose Society, March 28, 1900, the author describes a number of the more common diseases of the rose and suggests methods for treatment. The diseases described are nematodes, black spot, rose-leaf blight, rose mildew, downy mildew, rose rust, rose anthracnose, leaf spot, black speck, and bronzing.

Diseased violets (*Jour. Hort., 52 (1900), No. 2683, p. 188*).—Mentions attack of *Peronospora violæ* on violets. Recommends better ventilation and sprinkling powdered lime over diseased plants.

Liquid and powder fungicides, P. CARLES (*Messager Agr., 5. ser., 1 (1900), No. 7, pp. 260–263*).—Formulas and directions are given for the preparation of Bordeaux mixture of different strengths, Burgundy mixture, and a powder which consists of 750 gm. basic copper acetate and 1,250 gm. of pulverized plaster.

Spraying of fungicides, E. BRINGUIER (*Messager Agr., 5. ser., 1 (1900), No. 5, pp. 171–174*).—A critical statement on the preparation and application of fungicides.

A cyclone spray pump (*Queensland Agr. Jour., 6 (1900), No. 5, p. 381, fig. 1*).—A cheap form of spray pump is figured and described.

ENTOMOLOGY.

Report of the State entomologist, E. P. FELT (*Bul. New York State Mus., 6 (1900), No. 31, pp. 531–653*).—The report contains a general discussion of the work of the entomologist for the year in the field, office, and laboratory. Brief notes are given on the biological and economic relations of the following insects: Raspberry sawfly, locust borer, elm-leaf beetle, asparagus beetles, antiopa butterfly, forest tent caterpillar, and the seventeen-year cicada.

Experiments were conducted with arsenical poisons as treatment for the attacks of the elm-leaf beetle. Twigs of the English elm were placed in small water bottles which were kept in experiment cages. The leaves were sprayed by means of an atomizer with different arsenicals. The results obtained from these experiments indicate that arsenate of lead is slow in its action, but experiments conducted in the field indicate that when the application is thorough it is a very effective insecticide. Paris green, London purple, Paragrene, and lead arsenate were the arsenicals used in these experiments. An experiment upon nearly full-grown forest tent caterpillars demonstrated that this insect could be controlled by arsenical applications and that arsenate of lead was an effective spray for this purpose.

A detailed report is made on the volunteer entomological service of the State. The volunteer observers now number 43 and are located in 39 counties. A summary is given of the report from each observer. The author gives a list of 82 insects, specimens of which have been exhibited at farmers' institutes and similar gatherings for the purpose of giving instruction in the economic relationships of insects. A list is given of newspaper articles and other publications of the entomologist for the year.

Thirtieth annual report of the Entomological Society of Ontario, 1899 (*Rpt. Ontario Ent. Soc. 1899, pp. 127, pls. 2, figs. 66*).—This report contains the proceedings of the thirty-sixth annual meeting of the Entomological Society of Ontario, held in London, October 11 and 12, 1899, and the proceedings of the first annual meeting of the Northwest Entomological Society, held at Lacombe, Alberta, Northwest Territories, November 7, 1899.

A conference was held on the San Jose scale, during which W. Lochhead presented a paper on the economic aspect of the San Jose scale and its allies. A general discussion followed this paper.

The annual address of the president of the Entomological Society of Ontario contained suggestions regarding the organization of an entomologists' union, notes on the milkweed butterfly and other insects.

F. M. Webster presented a popular history of the past century of American entomology, and briefly discussed the subject of the native home of the San Jose scale (pp. 55, 56). The same author gave a brief note on the larval habits of *Uranotes melinus*.

W. Lochhead presented notes on some insects found on coniferous shade trees. These notes covered the subjects of the economic importance, life history, and habits of *Chermes abietis* and *Lygaeonematus erichsonii*. The attraction of electric light for moths was discussed by A. Gibson. It was noted that the male insects were attracted in much greater numbers than the females.

A paper on the injurious insects of the orchard, garden, and farm for the season of 1899 was read by W. Lochhead. This paper contained a discussion of the history and life habits of the codling moth, bud moth, tent caterpillars, several species of scale insects, Colorado potato beetle, squash bug, cabbage worm, cabbage aphis, grapevine leaf hopper, wheat-stem maggot, clover-root borer, etc.

C. J. S. Bethune reported a case of fatal bite from *Sinea diadema*. Brief notes were given by J. A. Moffat upon some Cuban insects—*Polistes lineata*, *Chloridea virescens*, etc. The same author discussed the wing structure of the milkweed butterfly.

A paper on Nature-study lessons upon the cabbage butterfly was read by W. Lochhead. T. W. Fyles gave an account of the structure, habits, and classification of spiders. Under the title "Notes on insects

of the year," W. H. Harrington gave brief accounts of the grain aphis, cabbage butterfly, pea weevil, currant aphis, tent caterpillars, etc.

J. D. Evans presented a brief note on the tent caterpillars, and A. Gibson gave a short account of the tussock moth, onion maggot, red spider, and *Rhopalosiphum violæ*. J. A. Moffat discussed the milkweed butterfly and other insects. C. J. S. Bethune presented a brief account of the tent caterpillars, squash bug, etc. T. W. Fyles gave an account of the tent caterpillars, milkweed butterfly, *Harpiphorus tarsatus*, *Tenebrioides mauritanicus*, *Metzneria lappella*, etc.

J. Fletcher gave an account of the appearance and destructiveness of a number of injurious insects, among which may be mentioned the asparagus beetle, scale insects, the destructive pea louse, black violet aphis, etc. C. J. S. Bethune reported some observations on the bumblebee's nest.

The proceedings of the first annual meeting of the Northwest Entomological Society include a report of the council, the president's address, and other brief notes.

Report of the entomological section, C. P. GILLETTE (*Colorado Sta. Rpt. 1899, pp. 37–41*).—Observations made upon the codling moth indicate that the insect is completely two-brooded, with no evidence of a third brood. Good results were obtained in fighting it by banding the trees. Kerosene emulsion was found to be practically valueless against the codling moth.

In making a study of the grasshoppers of the State it was found that the 2 species most concerned in injuries to cultivated crops were *Melanoplus bivittatus* and *M. differentialis*. Not a single specimen of the Rocky Mountain locust has been seen in the State for the past 9 years. The beet army worm (*Laphygma flavimaculata*) caused severe losses to the sugar-beet industry, 200 or 300 acres of beets being completely ruined by the attacks of this insect in the caterpillar stage. Field experiments demonstrated that the ordinary arsenical poisons are quite effective against it. The ash borer (*Podosesia syringæ*) is reported as rapidly increasing in numbers and as having killed many ash trees. Experiments conducted with arsenical mixtures indicate that Green Arsenoid and Pink Arsenoid are rather effective, while White Arsenoid was too injurious to the foliage.

Experiments have been conducted in the apiary for the purpose of determining the best form of foundation for comb honey and the best method of using the foundation in a section.

A new sugar-beet pest and other insects attacking the beet, R. W. DOANE (*Washington Sta. Bul. 42, pp. 14, figs. 5*).—Since October, 1896, the author has made observations on a new beet aphis (*Pemphigus betæ*) which was found, upon investigation, pretty generally distributed in the beet fields of the State.

The author gives a technical description of the species. The body

of the insect, including the legs and antennæ, is said to be covered with a white flocculent powder. Late in the season winged forms appear. The native food plants of the insect appear to be *Achillea lanulosa* and *Polygonum aviculare*. The insect passes the winter in the soil on or near the roots of the food plants. No males have been discovered in this species.

A wet spring followed by an early dry summer seems to be especially favorable to the multiplication of this insect. The prevalence of the beet aphis seems not to be conditioned by the character of the soil. No direct remedies are suggested. In the line of prevention the author recommends that beets should not be planted on new soil, since the native plants growing on such soils might be already infested. It is urged further that beets should not be grown for many seasons in succession upon the same ground.

Brief notes are given on the habits and life history of and remedies against *Psylliodes punctulata* and *Carneades messoria*.

Notes on a new sugar-beet pest with a description of the species, R. W. DOANE (*Ent. News, 11 (1900), No. 3, pp. 390, 391*).—A species of plant louse is described as new under the name *Pemphigus betæ*. The ordinary host plants of this species are *Polygonum aviculare* and *Achillea millefolium*. The insect lives upon the roots of these plants and is recognized by the flocculent secretion upon its body. Recently this species has attacked sugar beets and is becoming an insect of considerable economic importance. During the winter months the colonies of this insect consist of individuals in all stages of development. These colonies grow rapidly during April and May. During the summer, winged forms appear and increase in number until about the middle of November. They leave the plant and fly for considerable distances in search of new host plants. A technical description of the insect is added.

The grass thrips, W. E. HINDS (*Massachusetts Agr. Col. Rpt. 1899, pp. 83–97, pls. 4*).—The author made a study of an outbreak of the grass thrips which occurred in Massachusetts. The species was considered to be *Anaphothrips striata*. For the purpose of studying this species, specimens were brought into the laboratory and kept, in large-mouthed bottles, upon the stems of silver-topped June grass, which seemed to be the food plant preferred by them. It was observed that the females deposit their eggs in the fresh and tender portions of the leaf tissue. Oviposition takes place at night as well as in the daytime. The females which have passed the winter begin laying eggs very soon after the beginning of growth in the grass. The process of egg laying contiaues for 4 or 5 weeks and the number of eggs laid by a single insect in confinement averages about 50 to 60. The eggs of these hibernated females hatch in from 10 to 15 days, but during the summer generations the eggs hatch in from 4 to 7 days. The mature larvæ

select secluded places for pupation, either within the sheaths of the upper leaves or in the sheaths of leaves at the base of the stem. The duration of the pupal stage in the first generation is from 6 to 8 days. The various stages of the insect are described in a technical manner. Two forms of adult females are to be observed, one with wings and the other with only short wing pads.

About 98 per cent of the hibernating adults are wingless and from 90 to 95 per cent of the first spring generation develop wings. The females deposit eggs and young larvæ are to be found on the grass until winter, but only adults survive the winter. Specimens survived after being exposed to a temperature of 21° F. below zero. The laboratory work indicates that there are 8 or 9 generations per year, the length of the life cycle varying from 30 days for the first generation to 12 days during hot weather. No males were found, and it is believed that the species is parthenogenetic.

The adult insects feed upon the leaves of grass and are seldom found within the sheaths. The larvæ, on the other hand, seek more protected places for feeding. The greatest damage is done by this insect to June grass (*Poa pratensis*), timothy, and barnyard grass, but a considerable variety of other grasses are attacked. The females hibernate above ground and it is, therefore, suggested that burning in early spring would destroy great numbers of them. It was also observed that the injury from this insect was most severe on worn-out meadows and on fields that had been seeded for many years and had become partly exhausted. The author recommends, therefore, the application of fertilizers and deep plowing of old fields, to be followed with a cultivated crop for at least one year before reseeding.

Codling moth; a wasp that destroys the apple worm, U. P. HEDRICK (*Utah Sta. Bul. 64, pp. 31–42, figs. 7*).—The author's experiments in spraying for the codling moth have led to the conclusion that in Utah 4 sprayings are advisable for summer apples and 6 for winter apples, and that white arsenic is more effective than Paris green even when the latter is unadulterated.

The solution used in these experiments was made as follows: White arsenic 1 lb., unslacked lime 2 lbs., water 3 gal., the mixture to be diluted in 200 gal. of water. The applications were made on the following dates: June 6, June 21–22, July 11–12, July 24–25, August 13–14, and a sixth spraying during the first week of September. The cost of the 6 applications was about 25 cts. per tree. A table is given showing the number of trees of each variety sprayed and the number of wormy and sound apples gathered from these trees. The experiments were conducted upon 20 varieties of apples.

The author made observations upon a digger wasp (*Ammophila pruinosa*) which was observed preying upon the codling moth in an orchard near Logan. The wasps occupied 2 areas of about 4 and 1 sq.

rod extent, respectively. On August 20, 1898, the wasps were seen eating the cabbage worm and also the codling moth. The apple trees were loaded with fruit and were almost free from the codling moth, which was considered remarkable in view of the fact that apples in that region are usually badly infested. The owner had never been under the necessity of spraying these trees. The author collected a few larvæ of the codling moth and scattered them near the burrows of the wasps, and they were greedily seized upon by the latter. As a rule, the wasps cover the opening of their burrows upon leaving them. In an area 18 in. square 39 closed burrows were found with a depth of from 4 to 8 in. and a diameter of $\frac{1}{4}$ in. The burrows were for the most part unbranched, and at the terminus was to be found sometimes a single cocoon and at other times from 1 to 3 larvæ of the codling moth. The author describes the method by which the larvæ of the wasp feed upon the codling moth.

The apple plant louse, J. B. SMITH (*New Jersey Stas. Bul. 143, pp. 23, figs. 32*).—From observations made by the author during the past 3 years, it is concluded that the apple plant louse upon apple trees in New Jersey has no alternate food plant and, therefore, no "migrant" or "return migrant" forms. The species is *Aphis mali*, and may be distinct from the one which has been described by other authors as migrating from the apple tree to other food plants. On November 1, 1898, the author began observations upon a tree which was badly infested with this species. At this date many eggs had already been laid, and it was observed that both sexes of the insect were wingless. When the plant lice began to develop in the spring of 1899, daily observations were made for a time and specimens were collected at frequent intervals during the season.

The author reports in detail his observations upon the appearance and habits of the various generations which occur during a season, noting the anatomical characters by which the different generations may be distinguished. The life history of the apple plant louse, as observed by the author, may be summarized as follows: The species hatches from the egg as soon as buds develop in earliest spring. The stem-mother becomes mature and begins to reproduce about 15 days later. After another period of 9 or 10 days the second generation becomes mature, and it was observed that about three-fourths of this generation were winged. Two weeks later the third generation becomes developed, and about one-half of the individuals of this generation are winged. During the whole year there are 7 generations of parthenogenetic females, but no winged individuals are to be found except in the second and third generations. The winged forms leave the trees upon which they have developed, fly to other apple trees, and in this way bring about the wide distribution of this species. The individuals which fly from one tree to another are not to be regarded as repre-

senting the migrant forms, since there is no migration from the apple tree to other food plants. Sexed individuals appear in October, egg laying begins about the tenth of the month and continues until the latter part of November or first part of December.

Among the natural enemies of this insect observed by the author may be mentioned the following: Ladybirds, syrphus flies, lacewings, parasitic Hymenoptera and Diptera, and a fungus disease. As artificial remedies against the apple plant louse the author recommends spraying with the following insecticides: Kerosene emulsion mixed with 12 parts of water; a 5 per cent mechanical mixture of kerosene with water; fish-oil soap at the rate of 1 lb. in 6 gal. of water, or a tobacco decoction in a strength equal to an extract of 1 lb. of tobacco in 2 gal. of water. The insects are most vulnerable soon after hatching from the eggs, and the author recommends at this time a treatment with tobacco soap made by adding tobacco to a potash soap. Tobacco combined with fish-oil soap also gave satisfactory results. If the trees should become badly infested in summer, they may be sprayed with a strong solution of any of these substances late in September or during the first part of October.

Since the distribution of the insect is largely accomplished in the egg state on nursery stock, it is recommended that such stock be fumigated with hydrocyanic-acid gas before being sent out.

The forest caterpillar, G. H. Perkins (*Vermont Sta. Bul. 76, pp. 111–137, figs. 13*). The ravages of the forest tent caterpillar began to attract attention in Vermont in 1895. Serious outbreaks also occurred in 1896, 1898, and 1899. The author states that in many localities the damage of maple trees was not entirely due to the forest tent caterpillar, but that *Plagionotus speciosus* and the fall cankerworm committed serious depredations. It is stated that the forest tent caterpillars were so numerous in Montpelier that one man was able to collect 10 bu. of the caterpillars in 2 weeks' time. The author gives a description of the insect in its various stages, together with notes on its feeding habits and life history. Quotations are also given from letters of correspondents which show the great ravages committed by this insect upon shade trees and sugar maples, the damage to the latter being so severe that the customary amount of maple sugar will probably not be produced in Vermont for several years to come. Brief notes are given on the bird and insect enemies of the forest tent caterpillar. Of several hundred caterpillars collected in Addison County only one-third developed moths, the remainder being destroyed by *Pimpla conquisitor*. In another lot of 200 cocoons hatched in the laboratory, only 30 produced moths. A disease, apparently of bacterial origin, has also been observed among caterpillars.

Notes are given on the most approved methods of destroying the eggs, spraying, banding the trees, destruction of cocoons, and capture of moths.

Caterpillar plague, H. TRYON (*Queensland Agr. Jour., 6 (1900), No. 2, pp. 135–147, pls. 3, fig. 1*).—This article contains a general discussion of *Leucania unipuncta*, including an account of its food plants, a description of the insect in its various stages, notes on its habits, life history, distribution, and prevalence in Queensland. Among the insect parasites of this species the following may be mentioned: *Theronia rufipes*, *Ercphanes leucaniæ*, *Linnaemyia nigripalpus*, *Paniscus productus*, and *Apanteles ruficrus*. The first 3 species are described as new and are said to be of considerable economic importance. *Calosoma australis* is one of the more important of the predaceous insect enemies of Leucania. The following birds are reported as being effective in the destruction of the army worm: *Dacelo gigas*, *Strepera graculina*, *Corvus australis*, etc. The usual artificial remedies for the army worm are described and recommended.

Plague locusts, W. W. FROGGATT (*Agr. Gaz. New South Wales, 11 (1900), No. 3, pp. 175–183, pl. 1*).—A locust plague of considerable importance visited parts of Australia during the season of 1899, the species concerned being *Epacromia terminalis*. The author made a number of observations upon the numbers and habits of this species. The eggs were deposited in open red soil. It was observed that the number of males was far larger than that of females, there being about 40 of the former to one of the latter. A number of female locusts were examined for the purpose of determining the number of eggs, and 19 eggs were found in each locust examined. The locusts caused considerable damage to young grass and wheat. A description is given of the male and female of this species. The author recommends burning over the ground in order to destroy the young locusts soon after hatching. The leaves of the common garden larkspur and of the castor-oil plant were observed to be poisonous to the locusts. Locusts which ate the leaves and flowers of the larkspur died very quickly. A number of experiments were tried in spreading the African locust fungus among the locusts, but these experiments were begun too late in the season to be most effective, as the locusts had already acquired the power of flight.

Orchard technique: IV. Spraying the orchard, W. B. ALWOOD (*Virginia Sta. Bul. 100, pp. 81–104, figs. 10*).—The author gives details with regard to the spraying done in 1899 in an old neglected orchard which came under the care of the station. The first spraying was done March 17 with a solution of bluestone, the second April 28 with Bordeaux mixture, and the third May 12 with Bordeaux mixture to which was added 8 oz. of green arsenite to 50 gal. of Bordeaux. The total expense of these 3 applications was about 16.2 cts. per tree.

Three sprayings were carried out on a young orchard, March 13, April 26, and May 16–17. The first application was a weak solution of bluestone, the second bluestone, and the third green arsenite. The

total cost of the 3 applications amounted to 3.8 cts. per tree. The application of Bordeaux mixture and green arsenite is made for the purpose of checking apple scab, orange rust, leaf curl of peach, and destroying the tent caterpillar, bud moth, cankerworm, and curculio. A second application of the Bordeaux mixture and arsenical poison is made for the same purpose and for the additional purpose of destroying the codling moth. Figures are given showing the proper stages of the leaf, buds, and young fruit of the apple at which the various applications should be made. The author recommends a winter application of a weak solution of lye to trees for the purpose of ridding the trees of lichens, destroying hibernating forms of insects, and as a fungicide treatment for apple scab and brown rot. Such treatment is given at any time during the dormant period of the trees. Experiments in the winter treatment of the San Jose scale indicated that pure kerosene with a flash test of 120 to 150° is the cheapest and surest winter wash. The author gives brief notes by way of description of methods of making some of the common fungicides and insecticides together with a short account of the fire blight of pear.

Report of the entomologist, C. H. Fernald (*Massachusetts Hatch Sta. Rpt. 1899, pp. 98–102*).—The San Jose scale is reported in 30 localities within the State. The entomological department has been authorized to inspect nurseries upon request by the owners. Brief notes are given on *Phytonomus nigrirostis*, gypsy moth, and brown-tail moth. It is stated that F. J. Smith, of the Gypsy Moth Commission, has determined the composition of Raupenleim, so that this substance may now be manufactured in the United States.

Report on economic entomology for the year 1899, G. H. Carpenter (*Rpt. Council Roy. Dublin Soc., 1899, pp. 15, figs. 16*).—The author presents biological and economic notes on a number of farm and garden insect pests, including, among others, crane flies, death's-head moth, *Smerinthus ocellatus*, *Otiorrhynchus sulcatus*, *Tyroglyphus longior*, and *Hippobosca equina*.

Report of the Swedish state entomological station for 1899, S. Lampa (*Meddel. K. Landtbr. Styr., 1900, No. 65, pp. 48*).

Common diseases and insects injurious to fruits, S. A. Beach, V. H. Lowe, and F. C. Stewart (*New York State Sta. Bul. 170, pp. 381–445*).

"The purpose of this bulletin is to furnish the fruit grower with a concise account of the common diseases and insects most injurious to cultivated fruits in New York State and to present up-to-date directions for fighting them most efficiently and economically. . . . The various fruits are taken up in alphabetical order and under each one the diseases are first considered, then the insects. In the consideration of each particular disease or insect, it is the general plan of the bulletin to give first one or more descriptive paragraphs setting forth its general appearance, the chief features of its life history, and its economic importance. Then follows a statement of the remedial or preventive treatment which is recommended or suggested by the authors. Where nothing can be positively recommended, suggestions are made, pointing out what appears to be the most promising line of treatment."

The usefulness of the bulletin is much increased by the addition of an index of the fruits, diseases, and common and scientific names of insects and fungi.

Plant diseases and insect pests, C. P. Close (*Utah Sta. Bul. 65, pp. 57–97, pls. 6, figs. 5*).—This is a popular bulletin containing brief notes on approved methods of

making insecticides and fungicides, and a brief account of some of the more common fungus and insect enemies of fruit trees.

Insects injurious to forest trees, E. P. FELT (*Rpt. New York Com. Fisheries, Game, and Forests, 1898, pp. 31, pls. 3, figs. 11*).—The author gives a brief general account of the habits and metamorphoses of insects. Special consideration is given to the forest tent caterpillar, the leopard moth, *Sesia acerni*, *Plagionotus speciosus*, *Elaphidion villosum*, and *Pulvinaria innumerabilis*. In connection with each one of these insects, the author discusses its life history, food plants, natural enemies, and the approved remedies for combating it.

The significance of the terms phagocytosis and lyocytosis, J. ANGLAS (*Compt. Rend. Soc. Biol. Paris, 52 (1900), No. 9, pp. 219–221*).—In a study of the metamorphosis of Hymenoptera, especially of the genera Vespa and Apis, the author states that the disappearance of the larval organs or of the larval reserve food materials does not take place by phagocytosis, but that the process is better described as a chemical degeneration and dissolution produced by the extracellular digestive action of leucocytes and of other cells. This process is called lyocytosis by the author.

Bot flies, gadflies, and breeze flies, J. G. O. TEPPER (*Jour. Agr. and Ind. South Australia, 3 (1900), No. 7, pp. 564–566*).—Notes on the life history and habits of species of Tabanus, Œstrus, Hypoderma, and Gastrophilus.

The food of certain caterpillars of the Bombycidæ, L. DEMAISON (*Bul. Soc. Ent. France, 1900, No. 2, pp. 22, 23*).—Notes on the feeding habits of *Bombyx quercus*, *Megasoma repandum*, *Orgyia antiqua*, etc.

Combating Anthonomus pomorum (*Hessische Landw. Ztschr., 70 (1900), No. 11, p. 142*).—Experiments were tried in scraping the loose bark from 12 apple trees and painting on a band of axle grease. The bands were painted on the trees on January 17 and were inspected 14 times between that date and May 10. In all, 625 beetles were caught, with an average of 52 to the tree. It was observed that the insect was most plentiful in the period from the end of March to the end of April.

A contribution to the life history of Cartharia pyrenæalis, T. A. CHAPMAN (*Ent. Mo. Mag., 36 (1900), No. 431, pp. 75–78*).

A new gall gnat of the grapevine (Clinodiplosis vitis), G. LÜSTNER (*Ent. Nachr., 26 (1900), No. 6, pp. 81–84, pl. 1*).—The insect appears to be double brooded, the larvæ of the first generation being found in June and July and those of the second generation in August and September. The larvæ are found on the under side of the leaves and in the berries during the summer, and half-grown individuals were found in winter among the hairs of the leaf buds. Adults were seen from the beginning of September until November. Brief descriptions are given of the insect in its various stages. The eggs were found on brown spots of the leaves.

Galls on the leaves of Jambosa domestica, L. ZEHNTNER (*Indische Natuur, 1 (1900), No. 1, pp. 3–11, figs. 3*).—The author describes the appearance and structure of galls produced chiefly on the under side of the leaves of this tree by an insect belonging to the Psyllidæ. The insect is described and figured in its various stages. As remedies, the author suggests the removal and destruction of infested leaves.

Lasius fuliginosus and its habits of rearing fungi, G. LAGERHEIM (*Ent. Tidskr., 21 (1900), No. 1, pp. 17–29, figs. 7*).—The author made a detailed study upon the nature of a fungus found in the burrows of this species of ant. The fungus should apparently be referred to *Cladotrichum microsporum*. According to the author's observations, the fungus may be of only slight importance as a source of nutriment for the ants, but its luxuriant growth through all the chambers of the ant colony may assist in preventing the crumbling of the walls of these burrows.

The author believes that the presence of the fungus in the ant burrows is due to the deliberate care which the ants bestow upon the fungus and not to the inability of the ants to keep the fungus out.

Life history of Margarodes flegia, H. G. DYAR (*Canad. Ent., 32 (1900), No. 4, pp. 117, 118*).—The author gives descriptions of the different larval stages of this insect, which is reported as injurious to *Thevetia neriifolia* at Key West, Fla.

The fight against the Nun (Ocneria dispar L.), Y. SJÖSTEDT (*Meddel. K. Landtbr. Styr., 1900, No. 60, pp. 29*).

A parasitic organism in the intestine of Olocrates gibbus, L. LÉGER (*Compt. Rend. Soc. Biol. Paris, 52 (1900), No. 11, pp. 261–263*).—In the intestine of this beetle the author found a parasitic fungus to which the name Rhaphidospora is given. This parasite attacks epithelial cells of the intestinal wall. Its systematic position was not determined by the author.

The development of the wing in the Lepidoptera, W. F. MERCER (*Jour. New York Ent. Soc., 8 (1900), No. 1, pp. 1–20, pls. 5*).—Detailed anatomical studies on the wing development of *Pieris rapæ*.

The systematic position of the locust fungus imported from the Cape, D. MCALPINE (*Agr. Gaz. New South Wales, 11 (1900), No. 3, pp. 184–186, pl. 1*).—After a careful study of this fungus, which has been used with considerable success in destroying locusts in South Africa and has also been imported into parts of Australia, the author concludes that his original determination of this species was correct and that the fungus should be referred to *Mucor racemosus*.

Fumigation of nursery stock, S. A. BEACH (*New York State Sta. Bul. 174, pp. 8, figs. 2*).—The author gives a general account of the necessary apparatus and chemicals, and the method to be adopted in applying the treatment by hydrocyanic-acid gas to infested plants. A description is also given of a fumigation house which is suitable for this purpose.

Insecticides, C. H. JONES and B. O. WHITE (*Vermont Sta. Rpt. 1899, pp. 147, 148*).—Analyses are briefly reported of the following substances: Paris green, green arsenite, Laurel green, Bug Death, and Herbicide.

FOODS—ANIMAL PRODUCTION.

Food products examined, E. F. LADD (*North Dakota Sta. Rpt. 1899, pp. 12, 13*).—The author reports the composition of a number of samples of foods and feeding stuffs, including wheat breakfast food, wheat, flax bolls or hulls, spelt, spelt husks, and beef from a 3-year-old steer and from a cow 7 years old. The digestibility of the samples of beef cooked and uncooked was tested with pepsin solution. The results obtained follow:

Digestibility of cooked and uncooked beef in pepsin solution.

	Amount digested.			
	In 1½ hours.	In 3 hours.	In 6 hours.	In 18 hours.
COOKED.	Per cent.	Per cent.	Per cent.	Per cent.
Porterhouse steak from 3-year-old steer	89.10	90.60	....	95.50
Leg roast from 3-year-old steer	88.70	91.20	....	94.70
Leg roast from 7-year-old cow	86.90	90.00	....	94.80
RAW.				
Porterhouse steak from 3-year-old-steer	....	95.4	94.8	96.3
Leg roast from 3-year-old steer	....	91.7	93.8	95.2
Leg roast from 7-year-old cow	....	91.6	93.2	95.2

The relative digestibility of several sorts of fat by man: IV. On artificial culinary fats and their digestibility as compared with lard, H. LÜHRIG (*Ztschr. Untersuch. Nahr. u. Genussmtl., 3 (1900), No. 2, pp. 73-87*).—In continuation of work previously reported (E. S. R., 11, p. 660) experiments with a healthy man were made on the digestibility of lard, a commercial lard substitute, and a mixture of equal parts of the two, consumed with a mixed diet. The tests were of 3 days' duration. The average results follow:

Digestibility of lard and commercial lard substitute.

	In daily food.	In daily feces.	Digested.
	Grams.	*Grams.*	*Per cent.*
Lard eaten with simple mixed vegetable diet	102.72	5.83	94.33
Commercial lard substitute eaten with simple mixed vegetable diet	102.77	5.89	94.27
Mixture of lard and commercial lard substitute eaten with simple mixed vegetable diet	102.72	5.46	94.68

Introducing corrections for the lecithin of the feces and the total fat in the ether extract, which is not saponifiable, the digestibility of the 3 sorts of fat would be 96.36, 96.09, and 96.47 per cent. respectively.

The author concludes that, although the digestibility of the 3 sorts of fat was practically the same, the lard is much to be preferred for other reasons. He considers pure lard a satisfactory product, while the commercial lard substitute was a mixture of inferior animal fat with vegetable oils.

The feeding value of sorghum as shown by chemical analysis, R. W. THATCHER (*Nebraska Sta. Bul. 62, pp. 65-72*).—Analyses are reported of Early Amber sorghum cut (1) when the canes were 2 ft. high, (2) when the canes were 4 ft. high with a very few heads appearing, (3) when headed out, most of the plants being in bloom, and (4) after heading, most of the seeds being in the dough stage. The first two samples were analyzed immediately after cutting and the last two after curing. The composition of the different cuttings follows:

Composition of sorghum at different stages of growth.

	Water.	Water-free material.								
		Protein.	Fat.	Nitrogen-free extract.	Reducing sugars.	Sucrose.	Crude fiber.	Ash.	Nonalbuminoid nitrogen.	Albuminoid nitrogen.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Canes 2 ft. high (analyzed uncured)	87.68	10.60	3.64	42.60	(*a*)	(*a*)	28.12	15.04	0.55	1.15
Canes 4 ft. high (analyzed uncured)	85.09	6.95	2.48	45.47	11.87	.00	33.37	11.73	.27	.84
Heading out, most of the plants in bloom (analyzed cured)		4.66	2.14	53.35	16.37	.00	31.62	8.18	.16	.59
After heading, seeds in dough stage (analyzed cured)		3.85	1.99	47.58	19.06	.00	38.44	8.19	.15	.47

a Not determined.

On the basis of these analyses the feeding value of sorghum is discussed and compared with other crops.

"The feeding value of sorghum is greatest when the plant is young. As the plant matures, the feeding value decreases rapidly. Therefore the crop should be used, for pasture, at least, before the seeds form, and for hay at as early a stage as it can be well cured. Analyses of sorghum when young and of other pasture plants at the same stages of growth show that it is somewhat deficient in flesh-forming material, containing less than blue grass or *Bromus inermis*, about the same as timothy, and a little more than Indian corn. Analyses of sorghum fodder, in comparison with other fodders and hay crops, show it to have a somewhat smaller amount of flesh-forming material than most hay crops, and less than corn fodder, but more than straw of the small grains. The fondness which live stock evince for this fodder is doubtless due to its sweetness."

The digestibility of American feeding stuffs, W. H. Jordan and F. H. Hall (*U. S. Dept. Agr., Office of Experiment Stations Bul. 77, pp. 100*).—The value of digestion experiments with farm animals is discussed, as well as the methods generally followed and the extent of work of this nature at the experiment stations in the United States. The results of all such experiments with different farm animals, made up to the close of 1898 (378 in number), are summarized in tabular form. The material is also arranged to show the maximum, minimum, and average coefficients of digestibility of the principal feeding stuffs. The effect of individual peculiarity and the kind of animal upon digestibility is discussed, as well as the influence of the stage of growth of the feeding stuff, cooking, drying and curing, ensiling, grinding, wetting, quantity fed, and proportion of nutrients. This bulletin is designed to take the place of a compilation of a similar nature published several years ago (E. S. R., 6, p. 5).

Feeding young cattle, H. H. Griffin (*Colorado Sta. Rpt. 1899, pp. 56, 57*).—A feeding test was made at the Arkansas Valley Substation with 15 calves 7 to 10 months old. The average weight November 18 was 342.6 lbs. each. They were fed on alfalfa hay until December 1, and were then given a pound of corn chop per head daily. This amount was gradually increased until in 2 weeks they were fed 3 lbs. per head daily. A few sugar beets were then added to the ration. January 1 the calves were divided into 3 lots of 5 each and fed corn chop with sugar beets or oats, alfalfa hay being given *ad libitum*. On an average the calves were fed 178 days. At the conclusion of the test they were sold for \$4.60 per hundred, deducting 3 per cent for shrinkage. The financial returns are based on alfalfa hay and sugar beets at \$3 per ton, chop at 80 cts., corn at 70 cts., and oats at \$1 per hundredweight. The average daily gain, less shrinkage, was 1.49 lbs., and the cost of a pound of gain 3⅓ cts. In the author's opinion this test for the production of "baby beef" was successful.

The production and marketing of wool, H. W. Mumford (*Michigan Sta. Bul. 178, pp. 59–90, figs. 8*).—The production of wool in

Michigan and the best methods of improving this industry are treated of, the discussion being based in part on replies received to questions addressed to a number of wool dealers in different parts of the United States. Some of the principal deductions follow:

"Mutton growing with wool as an incidental product will continue to be a profitable industry. . . . Breed and feed affect the value of wool from the manufacturer's standpoint. Indiscriminate crossing is unprofitable. A sheep poorly nourished can not produce a healthy fleece. The manufacturer buys wool on the basis of its true value for manufacturing purposes. The grower, the local dealer, the commission man, and the scourer should each make an honest effort to satisfy his reasonable demands. . . .

"A small linen, or flax, or hemp twine is best for tying wool. . . . Coarse heavy paint marks should be avoided in marking sheep. More and better wool can be secured by early shearing. Loose, bulky fleeces sell best in the market. Country wool buyers can greatly aid in an effort to bring Michigan wools up to the standard by buying wool on its merits. By offering an advance in price for wools properly grown and prepared for the market, and by discriminating against poorly grown, dirty, or poorly tied fleeces. . . . Avoid lime and sulphur as a sheep dip."

Sheep in the coastal district, G. VALDAR (*Agr. Gaz. New South Wales, 11 (1900), No. 1, pp. 38-44, pls. 3*).—On the basis of trials at the College Farm and the testimony of a number of sheep raisers, different breeds suitable for the coastal region of New South Wales are suggested. The value of different cereal crops, grasses, leguminous crops, rape, and other crucifers for sheep feeding is discussed and a feeding experiment at the Hawkesbury Agricultural College briefly reported. Thirty Romney sheep and 8 Shropshire lambs were hurdled on ¼ acre of paspalum grass. After this was eaten, they were moved to a half-acre plat of white mustard and from this to an acre of rape. The test began June 22 and closed August 1. During this time the Romney lambs had gained 20¼ lbs. each and the Shropshires 30 lbs. Estimating the gain to be worth 3 cts. per pound, according to the author there would be a profit of $25.72 from the 1¾ acres on which the sheep were pastured. It should also be remembered that the droppings of the sheep were valuable manure and that there was no expense in harvesting the crop, and that probably a second and even a third crop could be obtained from the rape and mustard, while the paspalum is a perennial grass.

Animal food for poultry, W. P. WHEELER (*New York State Bul. 171, pp. 461-506, pl. 1*).—In continuation of previous work (E. S. R., 11, p. 276), 2 series of tests are reported with chickens, hens, and ducks on the comparative value of vegetable and animal food, the latter ration being supplemented in the second test by bone ash. In the first series 5 lots of from 23 to 51 chickens 1 week old at the beginning of the test were fed the ration containing the animal food, which was made up of corn meal, animal meal, ground grain, gluten meal, etc. Five similar lots were fed the vegetable ration, consisting of wheat, barley, oats, and a mixture of several grains and concentrated

feeds. In addition all the lots were fed green alfalfa, oyster shells, and grit. The composition of the feeding stuffs used in this and the following test is reported, as well as the amount of feed consumed, the gain in weight, and similar data. A number of chickens were removed from the different lots during the test. At the close of the test, which covered 8 to 16½ weeks, the average weight of the chickens fed the ration containing animal food was 2.46 lbs., of those fed the vegetable food 1.94 lbs., 23 per cent more food being required per pound of gain by the latter.

The 2 rations were tested with 2 lots of some 26 Pekin ducks 1 week old at the beginning of the test, which covered 10 weeks. After the first month the ration fed lot 2 (vegetable food) was changed, as it was evident that it "was very deficient in some respect, for before the end of the fourth week one-half of all the birds in lot 2 had died." For 2 weeks animal meal was added to the feed and then the original ration was resumed. Only 1 duck died after the change. At the close of the test the average weight of the ducklings fed animal meal throughout the test was 5.9 lbs., of those fed the contrasted ration 5.5 lbs., 2.6 lbs. of dry matter being required per pound of gain with the former lot and 6 lbs. with the latter. The cost of a pound of gain in the 2 lots was 2.7 and 10.1 cts., respectively. It is said that the principal advantage of animal food was rapid growth and early maturity, rather than ultimate size.

Four lots of 11 and 15 pullets were fed the contrasted ration for about 200 days. The lots fed the ration containing animal food produced more eggs than those fed the vegetable food and less dry matter was required per pound of egg. The relative fertility of the eggs from the hens fed the different rations was also tested. In general the more fertile eggs were obtained from the lots fed the animal food. This point was further tested with 2 lots of two-year-old hens fed the contrasted ration. Little difference was found in the character of the eggs.

The second series of tests was made under conditions similar to those mentioned above, except that the ration of vegetable food was supplemented by bone ash, the object being to learn whether the small gains made on vegetable food were due to a deficiency in the ash constituents. As finally agreed upon, the contrasted rations had practically the same proximate composition. Six lots of from 61 to 99 chickens 1 week old at the beginning of the test were fed for 11 weeks. The average weight of the chickens fed the contrasted rations was practically the same at the close of the test, ranging from 1.1 to 1.7 lbs. In every case the chickens fed the ration containing the animal food required on an average about 13 per cent more food per pound of gain.

The 2 rations were further tested with 2 lots of about 30 Pekin ducks a little over a week old at the beginning of the test, which covered 9

weeks. The average gain of the ducks fed animal food was 5.3 lbs., of those fed vegetable food and bone ash 3.3 lbs., 3.3 lbs. of food, costing 8.5 cts., and 4.3 lbs. costing 4.1 cts. being required per pound of gain, respectively. Two lots of about 14 laying hens were used for further testing the 2 rations. The test covered 210 days. The average egg production of the hens fed animal food was 119.4 eggs; of those fed vegetable food and bone ash, 112.7 eggs, the dry matter required per pound of eggs being 3 and 3.2 lbs., respectively. The cost of food per pound of eggs was 3.2 cts. for each lot. When tested for fertility the eggs from the former lot were, in the author's opinion, better from a breeder's standpoint. No difference, however, in the vigor of the chickens hatched from the eggs of the 2 lots was observed. The author summarizes his experiments and the deductions drawn from them as follows:

"In general, rations containing animal food appear more palatable than rations of somewhat similar chemical composition consisting wholly of vegetable food. Rations in which the lack of palatability was overcome by using an unusual variety of grain foods were inferior for growing chicks and laying hens and decidedly inferior for ducklings to rations in which nearly one-fifth of the dry matter was supplied by animal food. After the period of most rapid growth had passed and the young birds approached maturity the difference in the efficiency between such rations rapidly disappeared. . . .

"Although it was found possible, when using a large number of foods in contrasted rations of these kinds, to have the ordinary groups of organic compounds in approximately equal proportions, there was always a much larger amount of mineral matter in the one ration owing to the bone of the animal meal. So there was sometimes nearly three times as much phosphorus in the one ration as in the other. . . .

"From these results it appears that rations containing a necessary amount of protein and having the relation of the ordinarily considered constituents satisfactory may be inferior because of a lack of mineral matter, probably phosphates.

"Not enough data are now available to show to just what extent the deficiency of lime in the food for the younger chicks may have been responsible for inferior results. With laying hens lack of lime could not have affected the results considered, for oyster shells were freely supplied, and it has been shown that such material can make good the frequent deficiency of lime.

"It appears also that while a cheaper vegetable food ration can sometimes be made to equal or surpass in efficiency a ration containing animal food by supplementing it with suitable mineral matter, there are plain limitations to its economical use. For laying hens some animal food appears necessary for continued good results. Ducklings without an abundant supply of animal protein in the ration, together with a liberal proportion of mineral matter, seem unable to make any approximation to their normally rapid and most profitable growth.

"Although bone ash was used to make good an assumed deficiency in one ration and proved an efficient addition for the purpose, it should not be inferred that its purchase for feeding is to be generally recommended. It was necessarily used to obtain information. Bone ash in the market is expensive. The same amount of mineral matter can be obtained much cheaper in fresh bone or animal meal, of which food it constitutes an important part. In some instances, of course, dry bones, where no facilities exist for grinding, or green bones in questionable condition, can be safely and economically used when charred or reduced to ash. The very desirable organic matter associated with fresh or cooked bones should not be wasted."

Poultry experiments, W. P. Brooks and H. M. Thomson (*Massachusetts Hatch Sta. Rpt. 1899, pp. 49–55*).—The value for egg production of rations with wide and narrow nutritive ratios was tested in the winter and summer. In each case 2 lots of 20 White Wyandottes and 2 lots of 20 Barred Plymouth Rocks were used. The principal grain in the ration with the narrow nutritive ratio was wheat, and in the ration with the wide nutritive ratio corn. Therefore the tests are in effect a comparison of these two grains for laying poultry, supplemented by a variety of other food.

The winter experiment began October 25 and closed April 27. The summer experiment began May 1 and closed September 27.

The authors summarize the results of the tests as follows: "Our results with both breeds, both summer and winter, are greatly in favor of the ration richer in corn meal and corn. On its side we have (1) lower cost of feed, (2) from 23 to 91 per cent more eggs, (3) a far lower cost per egg, making possible a saving of from $4\frac{4}{5}$ to $16\frac{3}{4}$ cts. per dozen in the food cost of their production, (4) a greater increase in weight, and (5) a much earlier molt."

It was the intention to test the wide and narrow rations with Black Minorca pullets, but this test was discontinued owing to roup. The results are not given in detail. "The test with this breed was not . . . at all conclusive. . . . Up to the time the test was closed, however, the corn-fed Minorcas had laid about 50 per cent more eggs than the others."

Erroneous ideas regarding food value, H. Snyder (*Sanitary Home, 2 (1900), No. 3, pp. 53–55*).—The author points out a number of widespread popular errors concerning potatoes, mushrooms, white wheat flour, white and yellow corn meal, etc.

Domestic science in agricultural colleges, Juniata L. Sheppard (*Amer. Kitchen Mag., 12 (1900), No. 5, pp. 177–179, fig. 1*).—A descriptive and statistical article.

Handbook of domestic science and household arts, Lucy L. W. Wilson (*New York and London: The Macmillan Company, 1900, pp. XIII+407, ill.*).—This is a textbook giving concise directions for lessons on food and nutrition, cooking and serving food, cleaning, household pests, and other topics generally included under the term domestic science. The chapters are contributed by a number of different writers.

Bread and the principles of bread making, Helen W. Atwater (*U. S. Dept. Agr., Farmers' Bulletin 112, pp. 38, figs. 3*).—The cereal grains and the flours made from them are discussed, as well as yeast, the theory of fermentation, bread raised with yeast and with leaven, special breads, household and bakery methods of bread making, chemical composition of bread, imperfections and impurities, nutritive value as related to cost, and similar topics.

Samples examined by the station (*Connecticut State Sta. Rpt. 1899, pt. 2, pp. 93–100*).—The Connecticut Pure Food law and the law regarding commercial feeding stuffs are quoted and brief statements made concerning the foods and condiments analyzed by the station. These include 149 samples of coffee, 2 of coffee substitutes, 92 of soda-water sirup, 23 of bottled sirup, 5 of fruit juice, 90 of bottled carbonated drinks, 2 of peanut butter, 31 of food preservatives, 2 of borax, 3 of banana flour, 2 of butter and imitation butter, 213 of molasses and sirup, 45 of vinegar, 2 of honey, and 43 of milk and cream.

Food products examined for the dairy commissioner in the twelve months ended July 31, 1899 (*Connecticut State Sta. Rpt. 1899, pt. 2, pp. 157, 158*).—Brief statements are made concerning the samples of butter, molasses, honey, etc., examined.

Contribution to the study of slimy bread, A. JUCKENACK (*Ztschr. Analyt. Chem., 39 (1900), No. 2, pp. 73-81*).—The bacterial origin of slimy bread is discussed, many investigations being cited.

Vegetable cheese, C. F. LANGWORTHY (*Sanitary Home, 2 (1900), No. 3, pp. 55-57*).—A popular article describing the bean cheese or bean curd and other food products made in the Orient from soy beans.

The chemical composition of authentic samples of spices and spice adulterants, A. L. WINTON, A. W. OGDEN, and W. L. MITCHELL (*Connecticut State Sta. Rpt. 1899, pt. 2, pp. 100-105*).—Details are given of the analyses of pepper and other spices under the Connecticut pure food law.

Coffee, A. L. WINTON (*Connecticut State Sta. Rpt. 1899, pt. 2, pp. 106-111*).—Analyses of a number of samples of coffee under the Connecticut pure food law are reported. A marked decrease was observed during the year over the samples of adulterated coffee found in the previous year. The author believes this is due to the work of the station.

Carbonated, non-alcoholic beverages ("temperance drinks," "summer drinks") and fruit flavors, A. L. WINTON, A. W. OGDEN, and W. L. MITCHELL (*Connecticut State Sta. Rpt. 1899, pt. 2, pp. 112-137*).—Soda water, bottled carbonated beverages, and sirups are described, and the analyses of a large number of samples in accordance with the Connecticut pure food law are reported. Many of these contained coal-tar colors, artificial flavoring, and such preservatives as salicylic and boric acids.

Peanut butter and peanolia, A. L. WINTON (*Connecticut State Sta. Rpt. 1899, pt. 2, p. 138*).—Analyses of 2 samples of peanut butter are reported.

Composition of banana and plantain fruits (*Bul. Bot. Dept. Jamaica, n. ser., 7 (1900), No. 2, pp. 24-30*).—A partial reprint of an earlier publication.[1] The composition of green and ripe fruit and banana flour is quoted. The chemical and other analytical work on bananas and plantains of a number of investigators is summarized.

Banana flour, vinegar, milk, and cream (*Connecticut State Sta. Rpt. 1899, pt. 2, pp. 156, 157*).—Samples of banana flour, vinegar, milk, and cream were analyzed. It is stated that banana flour is prepared from the dried flesh of the fruit. The composition of the different sorts of banana flour follows:

Composition of banana flour of different sorts.

	Water.	Protein.	Fat.	Nitrogen-free extract.	Ash.
Flour from—	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Porto Rico bananas	13.43	3.50	0.47	79.82	2.24
Florida bananas	5.34	2.81	.66	87.45	2.90
Honduras bananas	10.33	2.87	.50	87.02	2.55

The use of chemicals for preserving food, M. GRUBER (*Oesterr. Chem. Ztg., 3 (1900), No. 4, p. 84*).—The legal situation regarding added food preservatives in Austria is treated of.

The use of added preservatives, T. SMITH (*New England Kitchen Mag., 12 (1900), No. 4, pp. 127-129*).—The author discusses the properties and methods of detection of a number of the more common food preservatives.

Chemical preservatives, E. H. JENKINS, W. L. MITCHELL and A. W. OGDEN

[1] Bul. Misc. Infor. Roy. Garden Kew, 1894, pp. 305-310.

(*Connecticut State Sta. Rpt. 1899, pt. 2, pp. 139–152*).—A large number of preservatives for milk, cream, wine, cider, and beer were examined.

"[According to the authors, their work] shows that milk and cream preservatives now on the market depend for their antiseptic effects on salt, formaldehyde, borax, and boric acid; and that if the directions given by the manufacturers are followed, a quart of milk will be dosed with from 0.01 to 0.05 gm. of formaldehyde or with 0.47 to 3.6 gm. of boric acid. Cream will receive from 0.94 to 5 gm. of boric acid per quart.

"Wine and cider preservatives have been found to contain formaldehyde, salicylic acid, boric acid, benzoic acid, and betanaphtol. The cider, treated as directed by the manufacturers of the preservatives, may contain 0.36 to 0.9 gm. of salicylic acid or 0.19 to 0.38 gm. of borax or 0.6 to 0.7 gm. of benzoate of soda per quart. The beer preservatives contain salicylic acid and sulphurous acid in form of sulphites or bisulphites, and beer treated with them may contain from 0.04 to 0.12 gm. of salicylic acid or 0.015 gm. per half-liter glass. Of sulphurous acid, preserved beer may contain 0.015 gm. per half-liter glass."

Report of the chemist (division of foods and feeding), J. B. LINDSEY ET AL. (*Massachusetts Hatch Sta. Rpt. 1899, pp. 103–107*).—This is a brief general account of the work of the chemical laboratory during the year, which included the examination of samples of water, dairy products, and feeding stuffs. Short notes are also given on feeding experiments and dairy studies, and on digestion experiments which are being conducted at the station.

Concentrated feed stuffs, J. B. LINDSEY ET AL. (*Massachusetts Hatch Sta. Bul. 64, pp. 31*).—A classification of concentrated feeding stuffs is suggested, and the analysis reported of a large number of samples of concentrated feeding stuffs, made in compliance with the Massachusetts law. The constituents determined were moisture, protein, and fat. The materials analyzed include cotton-seed meals, linseed meals, gluten meals and feeds, wheat middlings, mixed feed, wheat bran and shorts, cereal food by-products, brewers' grains, malt sprouts, Sucrene Dairy Feed, Blatchford calf meal, corn meal, hominy meal, oat feed, corn-and-oat feed, corn-oat-and-barley feed, Kafir corn, corn screenings, chop feed, shredded wheat, ground oats, barley meal, rye feed, rye meal, Marsden's new food product (ground corn shives), concentrated food, poultry feeds, scratching food, scratching grain, clover meal, cut clover, and meat and bone meal.

The standards adopted for the different concentrated feeds are quoted. The results of the analyses are discussed as follows:

"(1) The cotton-seed meals shipped into Massachusetts the past year were practically free from adulteration, yet the guaranteed meals averaged 1 per cent higher in protein, showing the advisability of buying only branded goods. The guaranty in all cases should be supported by the name of the manufacturer or wholesaler.

"Last spring several samples of dark-colored meal were taken by our inspectors, and a number of others were sent in for examination, which, upon analysis, gave a high percentage of protein, proving that color alone is not a safe guide.

"(2) Cleveland flax meal, old process and new process linseed meals, gluten meals, and gluten feeds are of fair average composition with the exception of the old process linseed meals, which are low in many cases.

"(3) Of the wheat feeds, the middlings show quite a wide variation in percentage of protein as a result of different methods of manufacture; the mixed feeds with few exceptions are of fair quality, and the brans are of a high and very uniform grade.

"(4) The oat feeds show the most serious adulteration of any feeds on the market. Many of them fall below 7 per cent in protein with an average of 45 per cent of coarse material."

Concentrated feeding stuffs, C. H. JONES and B. O. WHITE (*Vermont Sta. Rpt. 1899, pp. 139–143*).—The text of the Vermont law regulating the sale of concentrated feeding stuffs is quoted, and analyses made in compliance with this law are reported. The materials analyzed include cotton-seed meal, gluten meals and feed, cocoanut fiber feed, calf meal, middlings, cereal food by-products, horse feed, hen feed, corn and oats, chop feed, and ground rape seed. Some of the feeding stuffs are briefly discussed.

Commercial feeding stuffs, E. H. JENKINS ET AL. (*Connecticut State Sta. Rpt. 1899, pt. 2, pp. 159–196*).—A reprint of the analytical matter of Bulletin 130 of the station (E. S. R., 12, p. 70), with a discussion of the composition and uses of commercial feeding stuffs.

Feeding stuff inspection, H. J. WHEELER and B. L. HARTWELL (*Rhode Island Sta. Bul. 63, pp. 91–100*).—The text of the Rhode Island legislation regulating the sale of concentrated commercial feeding stuffs is quoted and the analyses reported of a number of samples of feeding stuffs in accordance with this act. The constituents determined were protein and fat. The analyses include American Poultry Food, Poultry Food, gluten meals, linseed meals and feed, old process oil meal, cotton-seed meal, barley sprouts, chop, Sucrene Dairy Feed, corn-oat-and-barley feed, provender, stock feed, oat feed, Fancy Feed Meal, Sugar Corn Feed, and barley feed.

On the composition and food value of mammals, birds, and reptiles, BALLAND (*Compt. Rend. Acad. Sci. Paris, 130 (1900), No. 8, pp. 531–533*).—Several analyses are quoted and reference made to earlier work.

Food value of oak moss, J. H. BARBER (*Pacific Rural Press, 59 (1900), No. 13, p. 197*).—Oak moss (*Ramalina reticulata*) is sometimes used as a cattle food. According to an analysis by M. E. Jaffa of the California Experiment Station, it has the following percentage composition: Water, 22.29; protein, 9.15; fat, 1.95; nitrogen-free extract, 48.37; crude fiber, 13.77; and ash, 4.5.

Food value of tall tarweed (*Pacific Rural Press, 59 (1900), No. 13, 197*).—The food value of tall tarweed (*Centromadia pungens*) is discussed and an analysis by M. E. Jaffa of the California Experiment Station briefly reported. The protein content was found to be 12.3 per cent and the fuel value 919 calories per pound.

Experiments on the digestive power of pigs, LILIENTHAL (*Landw. Wchnbl. Schleswig-Holstein, 50 (1900), No. 5, pp. 81–89*).—A comparison of the digestibility of different rations by several breeds of pigs, including Yorkshires, Berkshires, Holsteins and "Marschschwein." The latter is a breed very closely related to the European wild hog.

Cost of wintering beef herd, E. R. LLOYD (*Mississippi Sta. Rpt. 1899, p. 14*).—A summary of data given in Bulletin 60 of the station (E. S. R., 11, p. 1084).

Beef herd, E. R. LLOYD (*Mississippi Sta. Rpt. 1899, pp. 14, 15*).—A study is being made of the relative merits of native and grade Angus cattle for beef production. The average weights at birth and each month for 8 months of calves of the 2 breeds are tabulated.

Feeding tests to determine the relative value of corn, cotton seed, and cotton-seed meal for beef production, E. R. LLOYD (*Mississippi Sta. Rpt. 1899, pp. 13, 14*).—A summary of the results of feeding experiments previously reported (E. S. R., 11, p. 1068).

Milk substitute for calves, A. CRAWFORD (*Jour. Dept. Agr. West. Australia, 1900, Feb., p. 17*).—Oil cake and oatmeal 1:1 cooked, mixed with hay tea and a little milk, is recommended as a useful food for calves. The oil cake should be increased as the calf grows older.

What grains lack as poultry foods, F. H. HALL and W. P. WHEELER (*New York State Sta. Bul. 171, popular ed., pp. 6*).—This is a popular summary of Bulletin 171 of the station (see p. 276).

DAIRY FARMING—DAIRYING.

Feeding tests and their methods, J. L. HILLS (*Vermont Sta. Rpt. 1899, pp. 252-296, 310-351*).—Experiments, partly in continuation of work previously reported (E. S. R., 11, p. 382), were made to compare various rations and to test different feeding stuffs, to determine the effect of feeding liquid fat to cows, to compare methods of watering cows, to test the effect of grooming on production, and to determine the extent of experimental error in feeding tests. Fifty-six cows in all were used in the series of experiments which lasted from October 25 to June 6. Each experiment covered 4 or 5 weeks, one-third of which was considered preliminary. The number of cows used in the different tests varied from 1 to 14. In addition to hay and silage, and in some cases sugar beets or artichokes, the following mixed feeds were employed: (1) Cotton-seed meal, linseed meal, corn meal, and wheat bran (3:3:4:6); (2) cotton-seed meal, linseed meal, corn meal, and wheat bran (3½:3½:3:6); (3) buckwheat middlings, corn meal, and wheat bran (4:1:3); (4) equal parts of corn meal and wheat bran; and (5) corn meal and wheat bran (8:4). Eighteen different rations were fed.

Tables give complete data for the experiments, including weights of cows, barn temperatures, analyses, and digestible ingredients of the fodders and feeds, records of the individual cows, and results of experimental feeding on different rations. The author summarizes the details and results of the investigation as follows:

"*The relative feeding values of rations of equal balance.*—(*a*) *Medium nutritive ratios.*—The fodders and feeds used were hay, silage, and Buffalo gluten feed—nutritive ratio averaging 1:5.7, and the same roughages with mixed feed No. 1—nutritive ratio averaging 1:5.6. The former ration yielded to the unit of total dry matter eaten from 4 to 5 per cent greater product, and the quality of the milk remained unchanged.

"(*b*) *Wide nutritive ratios.*—The fodders and feeds used were hay, silage, and corn and bran, and the same roughages with Quaker oat feed—nutritive ratio in each case averaging 1:8.9. The former ratio yielded to the unit of total dry matter eaten from 2 to 3 per cent greater product, the quality of the milk remaining uniform.

"In the one case production to the unit slightly favored the ration which was fed the more liberally; in the other case 2 rations equally balanced and containing the same amounts of the sundry nutrients were of equal feeding value. The outcome of 3 years' trials of this kind indicates that uniform production is not to be expected of necessity when there are eaten equal amounts of digestible nutrients derived from divers sources.

"*The effect of adding raw or emulsified fat to a ration.*—Unemulsified cotton-seed oil and emulsified cotton seed, corn, and linseed oils were fed with bran or corn meal and bran, hay, and silage, as against the same rations without the oil. Milk yields to the unit of dry matter eaten were always increased when oil was fed, the increase amounting from 3 to 9 per cent. The amount of total solids and fat were increased by the cotton-seed oil feeding from 2 to 15 per cent, on linseed oil feeding 2 per cent, and on corn oil feeding not at all. The quality of milk was always improved at the outset of this class of feeding, but quickly returned to normal quality or became poorer than usual when corn or linseed oils were fed. The increased fat percentage—unaccompanied by rise in the percentage of solids-not-fat—was fairly permanent,

lasting from 4 to 6 weeks at least, when either raw or emulsified cotton-seed oil was used. Since the same changes were brought about when raw oil was fed as followed the use of emulsified oil, it is safe to say that in these trials emulsifying was without influence as a means of feeding fat into milk.

"*The feeding values of medium and wide rations.*—(*a*) *Grain rations equal in amount.*—The fodders and feeds used were hay, silage, and mixed feed No. 1, or the same roughages and Quaker oat feed. Nutritive ratios averaged 1:5.8 and 1:9.0. The producing power of a unit of dry matter was 7 per cent greater in the former ration. The fat content of the quality of the milk remained essentially unchanged.

"(*b*) *Grain rations unequal in amount.*—The fodders and feeds used were hay, silage, and 8 lbs. of Buffalo gluten feed, or the same roughages with 2 lbs. of corn meal and 1 lb. of bran. Nutritive ratios averaged 1:5.5 and 1:9.7. The unit of dry matter eaten in the medium ration made 5 per cent more milk than did that in the wide ration. Less but richer milk seemed to be produced by the scant ration.

"*The feeding value of buckwheat middlings.*—The fodders and feeds used were hay, silage, corn meal, bran, and buckwheat middlings, the same roughages with mixed feed No. 1 or corn meal and bran. A unit of dry matter eaten produced about 3 per cent more milk, solids, and fat in ration No. 1, and about 4 per cent less in the corn and bran ration than when the middlings were fed. The quality of the milk remained generally uniform, with, however, two exceptions.

"*The feeding value of artichokes.*—Hay, silage, and mixed feed No. 1, or hay, artichoke tubers and mixed feed No. 1 were fed to one cow. To the unit of dry matter eaten 10 per cent less milk was made on the silage ration.

"*Watering at will or at intervals.*—Cows fed a uniform ration were in alternating periods watered at will or at intervals, and in the former case made 2 per cent more milk. The effect upon quality can not be stated for reasons given in the body of the article.

"*The grooming of cows.*—Cows fed a uniform ration were in alternating periods groomed or left uncarded without appreciable effect either upon milk yield or quality.

"*Experimental error.*—Uniform rations were fed and uniform production ensued. A unit of dry matter made essentially the same milk, solids, and fat at one time as another, lactation changes being equalized. It is probably unsafe to lay stress on apparent differences in feeding values of much less than 5 per cent.

"*Relative values of various grain rations.*—Assuming that two-thirds of the manurial ingredients reach the soil, and allowing 20 cts. per hundred for skim milk, the total and the daily net gains of one ration over another in butter, skim milk, and manure, expressed in dollars and cents, are as shown in the table. In each case the ration first mentioned proved superior to its competitor:

Relative superiority of different rations.

Ration.	Days of feeding one cow.	Net gain from butter.	Net gain from butter, skim milk, and manure.	Daily net gain, one cow.
				Cents.
Buffalo gluten ration v. cotton-seed-linseed ration	529	$4.61	$6.05	1.14
Buffalo gluten ration v. ration of 2 parts corn, 1 part bran	276	−4.18	3.86	1.40
Cotton-seed-linseed ration v. Quaker oat feed ration	118	0.45	3.12	2.64
Corn and bran ration v. Quaker oat feed ration	118	0.00	0.75	.64
Cotton-seed-linseed ration v. buckwheat middlings ration	128	−0.72	−0.02	.00
Buckwheat middlings ration v. ration of corn and bran	72	0.92	1.14	1.58

"The Buffalo [gluten] ration proved superior to the others, the cotton-seed-linseed ration ranking second."

The effect of fatigue upon the quantity and quality of milk, J. L. Hills (*Vermont Sta. Rpt. 1899, p. 309*).—In this test, which is the third reported by the station (E. S. R., 8, p. 86; 11 p. 384), 6 fresh milch cows were driven 10 miles and shipped 50 miles by rail. They were not milked during the 18 hours occupied in traveling. A table gives the yield and composition of the milk one day, one week, and three weeks after arrival. The results are briefly discussed and compared with those of the earlier experiments.

"The cows, as a whole, gave about the same quantity of milk on the day after arrival that they did later. Its quality was far richer, however, at first than it was after some time had elapsed. Considering each animal individually it was found that three gave more, one less, and two the same yield after becoming accustomed to their new quarters; that the fat percentages were less in each case; and that the solids-not-fat were irregular, two increasing and one decreasing decidedly as time went on. . . .

"In the trials previously reported temporary milk shrinkage was observed. This was not seen to any great extent in the present tests. In all cases, as in the present instance, temporary enrichment ensued. The outcome of this series of tests clearly shows the folly of testing a cow's milk before she becomes 'at home' in new quarters and has recovered from fatigue."

The effect of food upon the quality of butter, J. L. Hills (*Vermont Sta. Rpt. 1899, pp. 296–298*).—In connection with experiments noted above and in continuation of previous work (E. S. R., 11, p. 385) a study was made of the effect of various concentrated feeding stuffs upon the quality of butter. The rations used contained hay and silage with cotton-seed meal, linseed meal, corn meal, and bran in two combinations; corn meal and bran in two combinations; corn meal, bran, and buckwheat middlings; Buffalo gluten feed; and Quaker oat feed. Cotton-seed oil, corn oil, and linseed oil in emulsions were also fed with the corn meal and bran ration. From March 8 to May 1, 44 samples of skim milk, buttermilk, and butter were obtained and analyzed. The results are given in tabular form.

The author states that apparently none of the grain feeds injuriously affected the quality of the butter.

"Volatile acids were uniformly and decidedly lowered, and the iodin numbers markedly increased in every case when oil was fed and for a while after its use was abandoned. This was more apparent when corn and linseed oils were fed than when the cotton-seed oil was used. The melting point of the product made when the latter oil was fed was raised. . . .

"The station dairyman's judgment of these butters was that the cotton-seed product was hard and of quite good flavor, that made on linseed oil was very soft and sticky and of an oily taste—a condition lasting until the second sample after the use of oil was discontinued—while that made on corn oil was somewhat soft and oily but fair in quality. . . .

"While it is unsafe with our present lack of knowledge concerning the methods of milk formation to assert actual transfer from food to milk, yet analytical results and practical experience are in accord with such a theory."

Milk from cows fed cotton-seed oil skimmed and churned more exhaustively than that from cows fed linseed oil or corn oil.

Record of the station herd for 1897–98, J. L. Hills (*Vermont Sta. Rpt. 1899, pp. 299–307*).—The record of 42 cows from November 1, 1897, to October 31, 1898, is given in tabular form and compared with records of the station herd during previous years, as already reported (E. S. R., 11, p. 383). The data given include the production of milk, fat, and solids by each cow, the cost of food eaten, proceeds from butter sales, and the value of the fertilizing ingredients in the food fed. Notes are given explanatory of the table. The average proceeds per cow over the total cost of food for the year was $34.15. The record of 19 of the cows belonging to the herd for 4 years and 24 for 3 years is summarized in the following table:

Average record of 19 cows for 4 years and 24 cows for 3 years.

	Yield of milk.	Fat content of milk.	Yield of butter.	Cost of food.	Cost of purchased grain.	Cost of food per pound of butter.	Proceeds of butter sales.
Average of 19 cows:	*Pounds.*	*Per cent.*	*Pounds.*			*Cents.*	
1894–95	5,864	4.94	338	$53.16	$19.92	17.6	$79.30
1895–96	5,927	5.01	347	43.54	14.75	13.5	79.77
1896–97	6,475	4.87	368	49.77	19.26	14.0	89.24
1897–98	5,631	4.95	318	46.54	15.48	15.1	81.85
Average of 24 cows:							
1895–96	5,657	5.12	338	42.56	14.45	13.3	77.76
1896–97	6,012	5.04	354	48.66	18.98	13.8	85.80
1897–98	5,698	5.00	325	46.98	15.71	15.0	83.69

Laws of the composition of cows' milk, and the detection of adulteration, H. Timpe (*Chem. Ztg., 23 (1899), No. 99, pp. 1040–1043*).—The author attempts to trace a relation between the protein and the fat. He shows, with the aid of a series of analyses of the milk from cows of different breeds, arranged in the order of fat content, that the range in protein content is only about one-third of that in fat content, and accordingly that the fat increases in the series about three times as fast as the protein. In the case of milk containing an average fat content of about 3 per cent the protein was about the same, but when the fat was lower than this the protein exceeded the fat; and when the fat was above 3 per cent the reverse was true. The author deduces the following formula for protein: Protein $= 2 + 0.35$ fat. He advances the hypothesis that the fat and a part of the protein are of common origin, being derived probably from the splitting up of the same basal material, while the rest of the protein is formed independently of the fat. This would indicate two kinds of protein in the milk. The part derived from the same source as the fat has a constant value of 2. Indicating this as protein *a*, and the other portion as protein *b*, the ash, sugar, and protein *a* may be regarded as practically constant in milk, while the fat and protein *b* are subject to wide variations. The last two bear a definite relation to each other, protein *b* being equal to 0.35 of the fat.

These generalizations were verified on milk from cows of different

kinds, in health and disease, and fed different rations. In milk from healthy cows there was only one case in which the protein did not bear the normal relation to the fat. The sugar content was found remarkably constant, fluctuating only from 4.4 to 5 per cent.

These regularities in the composition of milk are thought to furnish a reliable means for detecting adulteration. In skim milk the protein, as calculated by the above formula, will be lower than that found by analysis, while the ash and sugar will be normal. Water would lower the content of all the constituents without changing their relation to one another, but it would depress both the protein *a* and protein *b*, so that the total protein calculated by the formula would be higher than that found by analysis. The sugar content would be another indication of watering. Skimming and watering the same sample is somewhat more difficult to detect by this method, but unless both had been practiced to the same degree the disturbance of the relation between the fat and protein would be apparent.

In a later issue of the same journal (24 (1900), No. 3, p. 16) H. Höft discusses the above paper and takes exception to some of the conclusions.

The efficiency of a continuous pasteurizer at different temperatures, H. A. Harding and L. A. Rogers (*New York State Sta. Bul. 172, pp. 507–530, figs. 2*).—Introductory statements are made concerning dairying in Denmark and in the United States. The lack of success attending the use by Americans of the Danish method of butter making has led the station to undertake a study of the process, the results of which are to be published in a series of bulletins, of which this is the first. The terms pasteurization and sterilization are explained, and the discontinuous or household system of pasteurization for sanitary purposes and the continuous or Danish system adapted to butter making are discussed.

In the experiments at the station "the objective point was to determine the effect upon the germ life when milk was passed through a continuous pasteurizer at different temperatures." Milk was pasteurized at 70, 80, and 85° C. The apparatus used was made in Denmark, and is figured and described. The method of work is given, and data showing the age, weight, initial temperature, and acidity of the milk, the steam pressure in the boiler, the rate of pasteurization, and the germ content of the milk before and after pasteurization are tabulated. The milk was usually a mixture of portions 4, 12, 24, and 36 hours old and had an acidity requiring from 18.9 to 40 cc. of normal alkali to neutralize 1 liter. The samples averaged 350 lbs. The rate of pasteurization varied greatly. At 80° C. it was about 2,100 lbs. per hour. In the bacteriological tests neutral lactose agar was used as a nutrient medium. The plate cultures were kept at 30° C. and the colonies were counted at the end of 48 hours.

Results of the work are summarized as follows:

"At 70° C. (158° F.) the efficiency of the continuous pasteurizer varies greatly from day to day. Tests upon 14 different days gave an average of 15,288 living germs per cubic centimeter left in the pasteurized milk, with a maximum of 62,790 and a minimum of 120 germs.

"At 80° C. (176° F.) the reduction in germ content is both very uniform and very great. Tests upon 25 different days gave an average of only 117 living germs per cubic centimeter in the pasteurized milk, with a maximum of 297 and a minimum of 20 germs.

"At 85° C. (185° F.) the average reduction is not more marked than at 80° C., but the range of variation is less. [The average, maximum, and minimum of tests made upon 7 different days were, respectively, 114, 234, and 50 germs per cubic centimeter.] This temperature has the added advantage, according to Dr. Bang, of removing the danger from germs of tuberculosis in the milk.

"Even when the whole milk was heated to 85° C. the butter did not have a permanent cooked flavor."

On the manufacture of cheese from pasteurized milk, G. HAMILTON (*Milch Ztg., 29 (1900), No. 10, pp. 145, 146*).—Milk was pasteurized at 102° C. and used in the manufacture of sour-milk cheese and brick cheese. In making the sour-milk cheese 10 per cent of fresh buttermilk, obtained from churning cream ripened with a pure culture, was added to the pasteurized milk and the mixture kept at 30° C. until the required acidity was secured. Sour-milk cheese properly made in this way was considered better than that made from unpasteurized milk and the yield was also greater. Notes are given on the use of pasteurization in Saxony.

Dairy work, J. S. MOORE (*Mississippi Sta. Rpt. 1899, pp. 22–28*).—The results of feeding experiments with cotton seed, cotton-seed meal, and corn-and-cob meal, and a study of the effect of these feeding stuffs on the quality of butter previously reported (E. S. R., 11, pp. 1079, 1080) are summarized. Tables are given showing the amount and cost of food consumed and the milk and butter produced by each cow of the dairy herd during 1898. Tests of 7 registered Jersey cows are reported.

Feeding for milk (*Queensland Agr. Jour., 7 (1900), No. 1, pp. 25, 26*).—During 2 periods of 15 days each 6 cows were fed a ration of 20 lbs. of green chaffed maize and during the second period were given in addition $1\frac{1}{2}$ lbs. of molasses. Only a small increase in the yield of milk and butter followed the use of the molasses. The daily record of each cow is given.

The management of Shorthorn dairy cattle and young stock, R. E. TURNBULL (*Jour. British Dairy Farmers' Assoc., 15 (1900), No. 2, pp. 83–92*).

Heavy vs. light cows, G. H. v. SCHEELE (*Landtmannen, 11 (1900), No. 4, pp. 52–57*).

On the importance of good milkers, J. FRIIS (*Landmandsblad, 33 (1900), No. 8, pp. 90–98*).—A general discussion of the subject; a number of experiments are quoted, showing how the amount of milk yielded by cows varies according to the character of the work done by the milkers.

Milk test inspection law, C. H. JONES and B. O. WHITE (*Vermont Sta. Rpt. 1899, pp. 143–145*).—The text of the Vermont law relating to testing milk and cream at dividend-making creameries and cheese factories and the results of the operation of the law are given. The law requires that all glassware used in testing be certified as to its accuracy and that all operators be licensed after proving their ability. The

execution of the law is vested in the superintendent of the dairy school of the university.

Of 11,058 bottles tested during 9 months, 199 were found incorrectly graduated. A considerable number of pipettes and acid measures were also found incorrectly graduated. The effect of the passage of the law in increasing the accuracy of the apparatus used is noted. Of 286 applications for license as operators, 33 were refused because of inaccurate testing.

Continuous pasteurization of milk, F. H. HALL, H. A. HARDING, and L. A. ROGERS (*New York State Sta. Bul. 172, popular ed., pp. 6*).—This is a popular summary of Bulletin 172 of the station. (See p. 287).

Report of milk control station in Christiania for 1899 (*Norsk Landmandsblad, 19 (1900), No. 6, pp. 68–70*).—Tests of 39,158 samples of milk and other dairy products were made during 1899, the average results per month and year being given in the report. The average fat content for 33,831 samples of whole milk examined during the year was 3.473 per cent (maximum 5, minimum 2.5 per cent), and of 4,944 samples of cream 17.304 per cent ("common cream" testing between 11 and 24 per cent, and "whipping cream" from 25 to 38 per cent).—F. W. WOLL.

Report of the milk control station in Trondhjem, Norway, for 1899 (*Norsk. Landmandsblad, 19 (1900), No. 18, pp. 197–199*).—During the year 55,292 samples of dairy products, nearly all whole milk, were received and tested. The average fat content of 55,162 samples of whole milk was 3.57 per cent, against 3.50 per cent for 46,473 samples during 1898. The report states that "as is usual, the milk is lowest in fat in the spring, because the majority of the cows drop their calves at this season. It is characteristic that the fat content of the milk increases suddenly when the cows are let out on pasture. This increase occurs every year in the month of June. The high fat content is maintained during July, or may drop again then, as was the case in 1895 and 1897. During the fall months the percentages of fat are gradually increased, to decrease again toward the end of the year." The fat contents of the milk tested at the milk control stations at Christiania and Bergen (at each of which stations a similar number of samples of milk are tested annually) show identical changes as those given above.—F. W. WOLL.

On milk control in Germany, M. WEIBULL (*Meddel. K. Landtbr. Styr., 1899, No. 59, pp. 27–32*).

The Danish butter on the English market, B. BÖGGILD (*Tidsskr. Landökon, 1900, No. 6, pp. 286–300*).

Dairying in Denmark during 1899, B. BÖGGILD (*Tidsskr. Landökon, 1900, No. 3, pp. 116–148*).

The cooperative Danish creameries and their importance for the development of Danish agriculture, B. BÖGGILD (*Mälkeritid., 13 (1900), Nos. 21, pp. 305–322; 22, pp. 335–348; 23, pp. 363–369*).—An historical discussion of the growth and present condition of Danish cooperative creameries, with complete statistics relating to the subject.

Report of the State Swedish cheese export committee, 1895–1899, I. LINDSTRÖM ET AL (*Meddel. K. Landtbr. Styr., 1900, No. 66, pp. 17*).

Report of the Swedish State dairy agent in Manchester, England, for 1899 (*Meddel. K. Landtbr. Styr., 1900, No. 64, pp. 66*).

Danish butter, P. SCHIDROWITZ (*British Food Jour., 2 (1900), No. 16, pp. 91, 92*).

VETERINARY SCIENCE AND PRACTICE.

Fourteenth annual report of the State board of live stock commissioners, C. P. JOHNSON ET AL. (*Rpt. Illinois State Bd. Live Stock Commissioners, 1899, pp. 391*).—This report contains a

copy of the proclamation of the board of live stock commissioners of Illinois regarding the importation of Southern cattle. In their experiments with dips for the purpose of destroying the cattle tick on animals imported from the South some losses were experienced, but it is believed that such losses are due not so much to the dipping itself as to the fact that the dipping occurred at an inopportune time, or that the cattle were subjected to fatiguing drives or railroad journeys after the dipping. Detailed records are given of the inspection for actinomycosis at the Union Stock Yards of Chicago.

Special attention has been given by the board for a number of years to tuberculosis among dairy cattle. The regulations of the board provide that animals condemned and slaughtered after the tuberculin test shall be divided into 6 classes, for the purpose of adjusting the amount of indemnity to be paid the owner. Class A includes animals which upon *post-mortem* examination fail to disclose the presence of tuberculosis in any of their organs. For such animals the full valuation is paid as indemnity to the owner. The other classes are graded according to the more or less generalized condition of the tubercular infection, 75, 50, 35, 25, and 15 per cent of the appraisement being paid for animals in these classes. The number of animals tested was 3,655, and of this number 560 reacted sufficiently to warrant condemning, while 47 were isolated and held for a second test. The percentage of condemned animals was, therefore, 15.32.

The board made an investigation of the milk of a number of tuberculous animals, the milk being used for inoculating the experimental animals, and being also subjected to microscopical examination. The conclusions which are drawn from these examinations may be stated as follows: The tubercle bacillus is found in the milk of 35 per cent of tuberculous cows with sound udders. The tubercle bacillus is found with about equal frequency in the sediment and in the cream. The milk when concentrated produces tuberculosis in about 25 per cent of the inoculated guinea pigs. In a large number of cases pus cells were found in the milk, which would indicate that the udder was affected by tuberculosis. It is stated that in consideration of the greater susceptibility of the guinea pig, the concentration of the milk, and the fact that inoculations were made hypodermically, allowance must be made for the different conditions when these results are applied to the human subject.

Detailed notes are given on the occurrence in the State of glanders, cerebro-spinal meningitis of horses, and sheep scab. In an appendix to the report is found a complete record of the tuberculin tests already referred to.

Actinomycosis of man and animals, B. SCHÜRMAYER (*Centbl. Bakt. u. Par., 1. Abt., 27 (1900), Nos. 2, pp. 49-61; 3, pp. 101-106, pls. 2*).—This article contains a report of an extended series of experi-

ments by the author upon the variations in the organism of actinomycosis under different culture conditions. When this organism is cultivated in ordinary alkaline bouillon without peptone or salt, 3 morphologically distinct forms were observed: (1) Unbranched and branched filaments; (2) delicate threads with thickenings and without branches; (3) round large spheres. The second form was frequently seen to develop out of this third form.

Experimental cultures which were carried on for two years under the same conditions and with the same results led the author to conclude that the organism of actinomycosis may vary exceedingly as to its external appearance, has the power of adapting itself to the nutrient medium and external conditions, and passes through a series of stages, which include the bacterial type and reach to that of the higher fungi.

The organism is described by the author under the name of *Oospora proteus.* A detailed record is given of the appearance and behavior of the organism under different conditions and upon different culture media. The variations of this organism are compared with those of *Oospora bovis.* In some of the experimental cultures chlamydospores were formed, and the author believes that this and other pathogenic organisms will be found to be forms of a series which extends from bacteria into the higher fungi.

Tuberculosis of cattle, G. E. NESOM (*South Carolina Sta. Bul. 50, pp. 41, figs. 10*).—The first part of the bulletin is occupied with a general account of the nature and etiology of tuberculosis and a description of the method of applying the tuberculin test. A report is made on 200 cattle tested with tuberculin in the State. The cattle were distributed in 6 herds, and the presence of tuberculosis was demonstrated in only one herd. One doubtful case was found in the second herd. In one herd of 66 cattle, 61 of which were milch cows, 31 reacted. The veterinarian who had attended this herd had made a diagnosis of tuberculosis and had confirmed it by *post-mortem* examination. Of the animals in this herd 9 showed a temperature of 105° or more before injection, and 3 out of these 9 gave a reaction of over 2° after injection. The ages of the animals of this herd varied from 1 to 15 years. In the other herds which were tested only one animal was condemned as suspicious, and the *post-mortem* findings were not sufficient to make the diagnosis certain. The animal, however, was considered tuberculous. Out of 200 tested, therefore, 32 animals or 16 per cent were found tuberculous, 31 of these, as already indicated, being found in one herd.

In the treatment of tuberculous herds the author recommends that the Danish system of isolating suspicious animals be adopted. He further recommends a municipal inspection of meats and milk and the issuance of a license to dairymen only after all his milch cows have been tested.

Observations concerning the significance of streptococci in comparative pathology, V. A. MOORE (*Amer. Vet. Rev., 23 (1900), Nos. 10, pp. 687–697; 11, pp. 774–787; 12, pp. 849–860, figs. 14*).—The author gives a brief review of the literature on streptococcus and an account of the systematic position of this genus. A bacteriological investigation was made of 4 cases of suppurative cellulitis of cows, in which the foot or leg was affected. Streptococcus was found to be present in all cases. Other cattle inoculated with pure cultures of these organisms developed the same symptoms. Rabbits which were inoculated with pure cultures died with septicæmia within 48 hours after inoculation.

Samples of milk were taken from 8 different cows which were suffering from mastitis. The milk samples were taken with strict antiseptic precautions. Streptococci were found in considerable numbers in 6 out of the 8 samples. In 2 cases of foot rot of sheep, a form of streptococcus was found which proved fatal to rabbits when inoculated hypodermically. A bacteriological investigation demonstrated the presence of streptococcus in the following diseases of the horse: Fistulous withers, poll evil, peritonitis, omphalophlebitis, septic pneumonia, strangles, and infectious pneumonia.

The author also made studies of distemper and rabies of the dog. Streptococcus was found to be present in cases of distemper but not in rabies. Brief notes are presented on the use and importance of antistreptococcic serum.

The curability of glanders, J. MCFADYEAN (*Jour. Comp. Path. and Ther., 13 (1900, No. 1, pp. 55–59*).—The author conducted an experiment to determine the therapeutic action of mallein upon glanderous horses. A horse with clinical symptoms of farcy was tested with mallein on November 4, 1898, and reacted in a typical manner with elevation of temperature and swelling at the point of injection. The highest temperature recorded was 105.4°. On November 15 the horse received 6 cc. of mallein and after 15 hours exhibited a temperature of 105.8°. On November 26, 10 cc. of mallein was injected into the horse, with a consequent sharp temperature reaction. A dose of 20 cc. of mallein was administered on December 6 with similar results. Further injections were made on December 14, 20, 28, and January 13 with 40, 80, 100, and 120 cc. of mallein, respectively. On February 10 the horse was examined and the farcy lesions were found to be healed. The animal was tested with 1 cc. of mallein on the same date and failed to react. On March 27 a second dose of 1 cc. of mallein was given, with no temperature reaction. On April 6 the horse received 100 cc. of mallein with the result that the temperature rose to 103.8°. The same dose repeated on April 24 produced a temperature of 103°.

The horse was apparently cured of the original attack of glanders.

In order to determine whether the animal was also protected against subsequent infection, an inoculation of virulent glanders pus was given on June 13, 1899. On June 23 an injection of 1 cc. of mallein produced a typical reaction, and similar results were obtained by repeated injections on July 7 and 22.

The author concludes from the history of this case that glanders can apparently be cured by repeated large doses of mallein, but that animals thus treated are not protected against subsequent infections by the disease.

Recent investigations on the rôle of mosquitoes in spreading malaria, G. H. F. NUTTALL (*Centbl. Bakt. u. Par., 1. Abt., 27 (1900), No. 5, pp. 193–196; 6, pp. 218–225*).—This article is in continuation of previous compilations of the author on the same subject. The author reviews in a critical manner the literature of the subject, under the following heads: General literature, the influence of temperature on the development of the malaria parasites in Anopheles, the species of mosquito in which the different malaria parasites can develop, and the development of the æstivoautumnal parasite.

Purulent broncho-pneumonia of puerperal origin, G. MOUSSU (*Rec. Méd. Vét., Paris, 8. ser., 7 (1900), No. 3, pp. 105–111*).—A study of a number of cases in which it was shown that there was a postpartum infection, with a localization of the disease in the lungs.

Review of Prof. Bang's work with contagious abortion, C. E. MARSHALL (*Michigan Sta. Spec. Bul. 13, pp. 8*).—An abstract of the work of Prof. Bang bearing on this subject.

Experimental studies on blackleg, E. LECLAINCHE and H. VALLÉE (*Compt. Rend. Soc. Biol. Paris, 52 (1900), No. 6, pp. 139, 140*).—The authors found that the presence of the toxin is indispensable to the manifestation of virulence. Great numbers of the spores may be introduced into susceptible organisms without producing any effects, provided all toxin is excluded. Animals which have received spores without toxin are not rendered immune.

Failure with Seraphthin in Austria, GEIST (*Berlin Tierärztl. Wchnschr., 1900, No. 7, pp. 75–77*).—The author conducted experiments for the purpose of determining the value of this substance as a protective remedy against foot-and-mouth disease. Out of 120 animals which were inoculated with Seraphthin, 79, or 65.83 per cent, contracted the disease, while out of 99 animals which were not inoculated only 46, or 46.5 per cent, fell sick. The author believes this substance is worthless both as a curative agent and as a means of producing immunity.

Infectious mastitis in cows, K. WEBER (*Deut. Thierärztl. Wchnschr., 8 (1900), No. 6, p. 47*).—In cases where this disease affects only one quadrant of the udder, a thorough treatment with drainage is sometimes successful, resulting in a complete sequestration of the infected part.

Relapse in milk fever, BRU (*Rev. Vét. Toulouse, 25 (1900), No. 3, pp. 166–170*).—A discussion of the symptoms of this disease, together with an account of cases in which a relapse took place after an apparent recovery.

Traumatic pericarditis in cattle, G. DE BRUIN (*Rev. Vét. Toulouse, 25 (1900), No. 3, pp. 141–155*).—The cause of this form of pericarditis is the penetration of the pericardium by some foreign body. Such penetration comes from the second stomach, which is separated from the pericardium only by the diaphragm, and at a point in the diaphragm which undergoes comparatively slight movements during respiration. The disease usually assumes a chronic form and is very seldom acute. The majority of cases are fatal. A bibliography on the subject is added to the article.

Staggers in sheep, M. J. CLEARY (*Irish Agr. Organization Soc. Leaflet 8, pp. 4*).—The author gives notes on the life history of *Cœnurus cerebralis*, and recommends the destruction of the heads of affected sheep in order to prevent the spreading of the disease.

Œstrus ovis, J. F. BUTTERFIELD (*Jour. Comp. Med. and Vet. Arch., 21 (1900), No. 1, pp. 23, 24*).—From a study of the habits of this insect in Pennsylvania, the author concludes that the eggs are deposited in the nostrils of sheep earlier in the season than has usually been supposed. The only successful remedy consisted in trephining and washing out with tepid water. Injections of solution of alum water in the nostrils seemed to be slightly effective.

Protective inoculation against hog cholera, H. JOST (*Deut. Thierärztl. Wchnschr., 8 (1900), No. 6, pp. 45–47*).—Notes on the use of Susserin and on the occurrence of endocarditis in hog cholera.

Horse bots, R. HELMS (*Jour. Dept. Agr. West. Australia, 1899, Dec., pp. 23–28, figs. 2*).—An account of the life history, habits, and remedies to be used against *Gastrophilus nasalis*.

Inheritance of chronic roaring, A. LABAT (*Rev. Vét. Toulouse, 25 (1900), No. 3, pp. 155–166*).—The author presents a detailed discussion of the literature of the subject and shows from statistics that horses which are afflicted with roaring very frequently transmit a predisposition to this disease in their offspring.

A form of hemorrhagic septicæmia in ducks and chickens, A. RABIEAUX (*Compt. Rend. Soc. Biol. Paris, 52 (1900), No. 6, pp. 141–143*).—The pathogenic agent found in cases of this disease resembles that of chicken cholera. It is ærobic. Experiments indicate that the pigeon, rabbit, guinea pig, white rat, and dog, in addition to ducks and chickens, are susceptible to the disease.

Epizootic-parasitic gastritis of fowls, A. RABIEAUX (*Jour. Méd. Vét. et Zootech., 5. ser., 4 (1900), pp. 16–20, fig. 1*).—This disease, it is stated by the author, is caused by the presence of *Spiroptera nasuta* in the gizzard of fowls. Vermifugal treatment had very little effect, and the author recommends preventive remedies, such as cleanliness of the poultry quarters and careful destruction of infected fowls.

External parasites of poultry (*Farmers' Gaz., 59 (1900), No. 1, pp. 16, 17*).—Notes on bird lice, with suggestion of remedies.

The gape worm (Syngamus trachealis), R. KLEE (*Deut. Thierärztl. Wchnschr., 7 (1899), No. 52, pp. 465–468, figs. 3*).—The author gives a description of the worm and an account of its habits and life history. The remedies which are recommended by the author include the usual ones and also the intratracheal injection of 1 cc. of a 5 per cent aqueous solution of sodium salicylate. A brief discussion of the literature of the subject is given in connection with a bibliography of 32 titles.

The temperature of the common fowl, C. FÉRÉ (*Jour. Anat. et Physiol. Paris, 35 (1899), No. 6, pp. 808–816*).—A difference in the normal temperatures of the two sexes was noticed, as well as of different ages.

AGRICULTURAL ENGINEERING.

Report of the meteorologist and irrigation engineer, L. G. CARPENTER (*Colorado Sta. Rpt. 1899, pp. 42–51, pls. 6*).—The work of this department of the station during 1899, as in previous years (E. S. R., 11, p. 394), has been confined mainly to measurements of seepage, river flow, duty of water, and meteorological observations (see p. 220).

"The measurements to determine the gains or losses from seepage have been continued this year on streams previously measured. These include the Cache la Poudre, from the canyon to its mouth, a distance of 50 miles; the Big Thompson, about the same distance; the Little Thompson, a tributary of the Big Thompson;

the St. Vrain, from Lyons to the Platte, and its tributary, Left Hand Creek; the Rio Grande, from above Del Norte to the State line, a distance of about 100 miles; the Arkansas, from Canyon City to the Kansas State line, a distance of 200 miles; nearly 500 miles of river measurement in all for this particular purpose. . . . The general results of previous measurements are confirmed. A tendency to increase in the amount of water returning to the river is noticeable, especially on those streams where the return waters have some distance to pass to reach the stream. The Rio Grande is an exception in that a marked loss is noticeable at the rim of the valley. There is then a gain, but not enough to balance the loss."

A record in continuation of that of previous years is given of the weekly measurements (April 18 to November 28), by means of automatic instruments, of the flow during 1898 and 1899 of the Cache la Poudre River at a point about 12 miles from Fort Collins. The watershed above the point of measurement exceeds 1,000 square miles. The average of the weekly measurements was 431 cubic feet per second in 1898 and 860 in 1899, the normal for 15 years being 708 cubic feet per second. Of the quantity so measured an amount not exceeding 150 cubic feet per second is water diverted from other watersheds than that of the Cache la Poudre. Weekly bulletins of the flow have been prepared for the local use of papers in northern Colorado.

The results of several years' observations on the duty of water are being prepared for publication.

The effect of forests on the preservation of snow is illustrated by reproductions of photographs.

The use of water in irrigation in Wyoming, B. C. BUFFUM (*U. S. Dept. Agr., Office of Experiment Stations Bul. 81, pp. 56, pls. 8*).—This bulletin describes studies by the author during the past 9 years on the use of water in irrigation in Wyoming, and gives his conclusions regarding certain measures and methods needed to secure the largest service from the available supply. It discusses the application of water to crops, water measurements in Wyoming, duty of water, the irrigating season, and continuous flow as a basis for appropriation.

"In the region under discussion irrigation is chiefly from small streams, and nearly all of the water supply which can be diverted is appropriated, but large volumes of water still run to waste in the larger rivers. It is along these that we must look for future development, but the utilization of this supply involves questions outside the scope of this investigation. These large rivers as a rule drain the mountain summits and have a more uniform flow than the small streams, as the snows which feed them melt slowly. The small streams, on the contrary, fluctuate so widely in volume that it usually happens that more water runs to waste before irrigation of cultivated crops begins than is available for use in July, when the need for such crops is greatest. It is also an unfortunate circumstance that the most remunerative crops are those which require late irrigation. Sugar beets, potatoes, alfalfa, and orchards all require irrigation in August and September, which is the season of the least supply. These crops, while bringing large returns, require, as a rule, but little water, and their cultivation will secure a much higher average duty than now prevails; but to greatly extend the area of these products will involve comprehensive measures to increase through storage the present volume available for use in July, August, and September, because on three-fourths of the Wyoming streams there is now a scarcity in these

months. If this shall not prove feasible, then the future extension of the areas now irrigated will come chiefly through the cultivation of crops which can be brought to maturity by water supplied before June 15. Among these, forage crops take first rank, as they can be irrigated as soon as water can be turned in ditches, and the stimulus given by a single watering will secure at least a partial crop. All these crops, however, are wasteful of water, and if they are to predominate in the extension of the reclaimed area, as will be necessary without storage, we may expect to see the average duty remain fully as low as at present."

Silo construction and silage, C. M. CONNER (*South Carolina Sta. Bul. 51, pp. 15, figs. 6*).—The value of the silo to the southern dairyman as a means of providing succulent food for dairy animals during long dry summers is briefly discussed, and detailed directions, with illustrations, are given for the construction of a round silo; with suggestions as to location, size, method of filling, and crops to be grown for silage. The methods and details of construction described are those followed by the author in building a silo at the South Carolina Station.

On drainage of marshes, H. STEINMETZ (*K. Landt. Akad. Handl. Tidsskr., 39 (1900), No. 3, pp. 191–203*).

Report of trials of agricultural machinery, U. SVERDRUP ET AL (*Christiania, 1900, pp. 36, illus.*).—The report gives detailed results of trials of 40 different makes of plows, the trials being conducted by a committee of the Royal Society for Norway's Weal.

Agricultural machinery in Denmark in 1899, C. V. BIRK (*Tidsskr. Landökon, 1900, No. 3, pp. 149–164*).

Trials of common plows and wheel plows, P. ULLBERG (*Landtmannen, 11 (1900), No. 13–14, pp. 197–202, 215–218*).

Trial of the potato harvester "Cambrian," U. SVERDRUP ET AL (*Tidsskr. Norske Landbr., 7 (1900), No. 1, pp. 38–40*).

The social, commercial, and economic phases of the road subject, W. H. MOORE (*U. S. Dept. Agr., Office of Public Road Inquiries Circ. 34, pp. 8*).—A paper by the president of the State and Interstate Good Roads and Public Improvement Association.

STATISTICS—MISCELLANEOUS.

Twelfth Annual Report of Arkansas Station, 1899 (*Arkansas Sta. Rpt. 1899, pp. 8–134*).—The report proper contains the organization list of the station, a financial statement for the fiscal year ended June 30, 1899, and a brief report by the director. Bulletins 56–60 of the station on the following subjects are reprinted: Tomatoes, cabbage, and onions (E. S. R., 11, p. 242); the relative virulence for the domestic animals of human and bovine tubercle (E. S. R., 11, p. 689); an experiment in grazing a corn and cowpea field with steers (E. S. R., 11, p. 965); yield of Spanish peanuts planted at different distances (E. S. R., 11, p. 927); planting unshelled peanuts (E. S. R., 11, p. 923); relative effects of cotton meal, whole and crushed seed, on the yield of corn, cotton, and potatoes (E. S. R., 11, p. 926); relative effects on cotton and corn of certain leguminous crops turned under entire and their stubble only turned under (E. S. R., 11, p. 921); Allen Hybrid cotton (E. S. R., 11, p. 926); the comparative yield of corn from seed of the same variety grown in different latitudes (E. S. R., 12, p. 136); second report on Arkansas seedling apples (E. S. R., 12, p. 151).

Twelfth Annual Report of Colorado Station, 1899 (*Colorado Sta. Rpt. 1899, pp. 113, pls. 8, dgms. 6*).—This contains the organization list of the station, a financial

statement for the fiscal year ended June 30, 1899, a report of the director discussing at some length the organization and work of the station and substations, an inventory of station equipment, detailed outlines of station work for 1899, and reports of the heads of departments and superintendents of substations noted elsewhere.

Fifteenth Annual Report of Maine Station, 1899 (*Maine Sta. Rpt. 1899, pp. 171*).—This contains the organization list of the station, a brief report by the director, and reprints of Bulletins 48–57 of the station on the following subjects: Feeding stuff inspection (E. S. R., 10, p. 1089), care of orchards (E. S. R., 11, p. 153), fertilizer inspection (E. S. R., 11, p. 137), feeding stuff inspection (E. S. R., 11, p. 279), the spraying of plants (E. S. R., 11, p. 262), fertilizer inspection (E. S. R., 11, p. 829), nuts as food (E. S. R., 12, p. 78), cereal breakfast foods (E. S. R., 12, p. 69), apple insects of Maine (E. S. R., 12, p. 68), experiments with potatoes (E. S. R., 12, p. 140). A list of acknowledgments, meteorological observations, and a report of the treasurer for the fiscal year ended June 30, 1899, are also included.

Twelfth Annual Report of Massachusetts Hatch Station, 1899 (*Massachusetts Hatch Sta. Rpt. 1899, pp. 125*).—A brief summary is given of station work during the year, which includes also a list of officers of the station and a list of station publications now available for distribution. A financial statement is given for the fiscal year ended June 30, 1899. Reports of the agriculturist, botanists, meteorologist, horticulturist, entomologist, and chemists, parts of which are noted elsewhere, are included, which review in detail the different lines of station work during the year and give results in some cases.

Twelfth Annual Report of Mississippi Station, 1899 (*Mississippi Sta. Rpt. 1899, pp. 47*).—This contains the organization list of the station, reports of the director and treasurer for the fiscal year ended June 30, 1899, and departmental reports, parts of which, together with notes on forage crops and a meteorological summary, are noted elsewhere. Reprints of Bulletins 53 to 59 of the station, with the exception of Bulletins 55 and 57, on the following subjects are appended: Some insects injurious to stock and remedies therefor (E. S. R., 11, p. 272), Irish potato culture (E. S. R., 11, p. 241), grapes (E. S. R., 11, p. 253), soils of Mississippi—texture and water conditions (E. S. R., 11, p. 328), and analyses of commercial fertilizers (E. S. R., 11, p. 528).

Tenth Annual Report of North Dakota Station, 1899 (*North Dakota Sta. Rpt. 1899, pp. 56*).—This contains the organization list of the station, a brief general report on station work during the year, detailed reports on the work of the different departments, parts of which are noted elsewhere, and a financial statement for the fiscal year ended June 30, 1899.

Twelfth Annual Report of Vermont Station, 1899 (*Vermont Sta. Rpt. 1899, pp. 119–354*).—This includes the organization list of the station, financial report for the fiscal year ended June 30, 1899, report of the director reviewing at some length the work and publications of the station during the year, abstracts of Bulletins 60–71 of the station, and departmental reports abstracted elsewhere.

Record of six years' work at the Plains Substation, J. E. PAYNE (*Colorado Sta. Rpt. 1899, pp. 71–95, pls. 5, fig. 1*).—This station has previously been known as the "Rainbelt Substation." The record here given is a summary statement of the results secured at the station with a large number of farm, orchard, and garden crops for each of the years the station has been in existence. The results are largely negative.

Report of the Rainbelt Substation, J. E. PAYNE (*Colorado Sta. Rpt. 1899, pp. 52–55*).—The report includes notes on fruit set out at the station and now living, on the growth of certain field crops, and recommendations as to further work.

The agricultural experiment stations in the United States, A. C. TRUE and V. A. CLARK (*U. S. Dept. Agr., Office of Experiment Stations Bul. 80, pp. 636, pls. 153*).—This is an exhaustive report on the history and present status of the agricultural

experiment stations in the United States prepared as a part of the experiment station exhibit at the Paris Exposition. It includes a statement concerning the general agricultural conditions in the United States as related to the work of the stations; an historical review of the organization and development of the stations, together with an account of the early experimental work carried on by the agricultural colleges and other institutions prior to the establishment of the stations under the Hatch Act; a statement of the relations of the stations to the Federal Government and to several associations, accounts of which are given; a discussion of the organization, equipment, lines of work, and general results of the work of the stations; an extended account, comprising the larger part of the volume, of the Office of Experiment Stations and of the individual stations, giving in each case the history, organization, equipment, financial support, lines of work, publications, and general results of work; and an appendix containing an account of the inspection work of the stations with the principal features of the laws under which it is carried on, the general statistics of the stations, a list of the publications issued by them since their organization, a descriptive account of the card index of experiment station literature, a list of books published by experiment station workers, and a catalogue of the experiment station exhibit at the Paris Exposition.

Statistics of the land-grant colleges and agricultural experiment stations in the United States for the year ended June 30, 1899 (*U. S. Dept. Agr., Office of Experiment Stations Bul. 78, pp. 39*).—A summary of this has already appeared (E. S. R., 11, p. 801).

Farmers' institutes: History and status in the United States and Canada, L. H. BAILEY (*U. S. Dept. Agr., Office of Experiment Stations Bul. 79, pp. 34*).—This bulletin gives a general survey of farmers' institutes and historical and statistical information regarding the movement in the different States and Provinces. A list of officials in charge of farmers' institutes in the United States is appended.

Experiment Station Work—XIV (*U. S. Dept. Agr., Farmers' Bul. 114, pp. 28, figs. 5*).—This number contains articles on the following subjects: Influence of salt and similar substances on soil moisture, extra-early potatoes, rotting of cranberries, chestnuts, low-grade Paris green, crude petroleum as an insecticide, skim milk in bread making, best number of hens in one pen, nest box for egg records, and profitable and unprofitable cows.

Crop circular for April, 1900, J. HYDE (*U. S. Dept. Agr., Division of Statistics Crop Circ. Apr., pp. 4*).—This contains notes and tabulated data on the condition of winter wheat and rye and of farm animals throughout the United States on April 1, 1900, and estimated losses of horses, cattle, sheep, and swine from exposure and disease during the year ended March 31, 1900.

Agricultural imports and exports, 1895–1899 (*U. S. Dept. Agr., Section of Foreign Markets Circ. 22, pp. 15*).—Tables are given showing the nature, quantity, and value of the agricultural imports and exports of the United States during each of the 5 fiscal years, 1895–1899.

Warehouses: A study of the organization of the grain trade in America, India, and Russia as well as in some German States, O. BÖHM (*Die Kornhäuser; eine Studie über die Organisation des Getreide Verkaufes in Amerika, Indien, und Russland, sowie in einigen deutschen Staaten. Stuttgart: J. G. Cotta, 1898, pp. 96*).

NOTES.

Alabama College and Station.—B. B. Ross, professor of chemistry in the college and State and station chemist, has been granted a year's leave of absence, which he will spend in study in Europe. During his absence J. T. Anderson, associate chemist of the station, will be acting State and station chemist, and Paul Murrill, recently of the University of Michigan, will be acting professor of chemistry in the college. C. F. Austin, a graduate of the Michigan Agricultural College, and formerly connected with the Montana Station, has been appointed assistant horticulturist of the station. A residence is being erected for the assistant agriculturist.

Arizona Station.—David Griffiths, Ph. D., has been appointed botanist of the station. He is to make a specialty of range study and improvement, in which work the Arizona Station is cooperating with the Division of Agrostology of this Department. Three hundred and twenty acres of worn-out range near Tucson is now under fence and is to serve as a main reserve for this study.

California Station.—C. A. Colemore has been appointed clerk to the director, *vice* A. V. Stubenrauch, resigned. The post-office address of the Southern California Substation has been changed from Pomona to Ontario, and the station now has the advantage of the rural delivery system. Some important changes are under way at the substation near Paso Robles. For the past ten years a large number of deciduous fruit trees have been tested upon land underlaid at a few feet by a very thick bed of siliceous hardpan. This orchard is being removed, and the result of the tests will shortly appear in a bulletin. Several Phagodia and two new Atriplexes from South America have been successfully grown at the substation and their culture is to be tested on a larger scale. Five successive dry seasons in the Paso Robles region have emphasized the need of drought-resisting forage plants, and 9 species of perennial grasses, out of some 60 tested in recent years, are considered worthy of more extensive planting. A dairy herd of 17 cows has been placed at the service of the central station, and feeding experiments will be conducted with sugar-beet pulp, and later comparative experiments will be made with cocoanut and other oil-cake meals.

Colorado College and Station.—F. L. Watrous, who has been assistant in agriculture for a number of years, has resigned, to take effect January 1, 1901. Clarence J. Griffith, former instructor in dairying at the Iowa Agricultural College, has been appointed to the same position in this college.

Georgia Station.—The efforts of this station to encourage the general adoption of the plan of harvesting the corn crop by cutting down the entire stalk and shocking, and afterwards shredding the dried stover, are meeting with very gratifying success. It is probable that in the course of a few years farmers in the South will generally adopt the plan so long pursued in the North and West, thereby adding several million tons of good forage to the food resources of this section.

Iowa College and Station.—John Craig has resigned his position as horticulturist to take charge of university extension work in New York. John A. Craig has been made assistant director in addition to his duties as professor of animal husbandry.

Kansas College and Station.—E. R. Nichols, who was acting president of the college for the year ended June 30, 1900, has been elected president. The year just concluded has been one of the most successful in the history of the institution. The

total attendance was 1,094, which was far in excess of any previous year. Paul Fischer, veterinarian in the college and station, has resigned to accept the newly established professorship of bacteriology and animal pathology in Ohio University.

KENTUCKY STATION.—J. B. Marcum, of Jackson, Ky., has been made a member of the governing board; J. W. Nutter has been appointed dairyman, and J. D. Turner and R. M. Allen clerks at the station.

U. S. DEPARTMENT OF AGRICULTURE.—William Saunders, for the past thirty-eight years Superintendent of Experimental Gardens and Grounds, died September 11, 1900, at the age of 78 years. He has been succeeded by B. T. Galloway, who in turn has been succeeded by Albert F. Woods as Chief of the Division of Vegetable Physiology and Pathology. The Secretary of Agriculture has published the following general order: "For the purpose of unifying the work of certain branches of the Department it is hereby ordered that the Chief of the Division of Vegetable Physiology and Pathology, the Chief of the Division of Agrostology, and the Chief of the Division of Pomology confer upon all matters of general policy and plan with the Superintendent of Experimental Gardens and Grounds, who is hereby designated as Director of Plant Industry. In carrying out this order the several branches of the Department named will maintain their present integrity and organization." A laboratory for the physical and chemical study of road materials has been established in the Division of Chemistry. "The object of the establishment of this laboratory is to secure the widest possible knowledge of the nature of road materials, their resistance to stress, their hardness, their power of absorbing water, their deportment in freezing temperatures, their cementing properties when reduced to powder, either alone or when mixed with other substances, their chemical composition, and their geological origin and distribution."

MISCELLANEOUS.—According to *The Country Gentleman* the Doylestown (Pa.) Farm School has been proffered a 150-acre farm in Bucks County, valued at $50,000, on condition that an endowment is provided for its maintenance. This is to be run as an annex to the school at Doylestown, for training girls in farmhouse work. The school has also received a contribution of $10,000 from a friend in Switzerland, to be used for buying farms "on which graduates may test their abilities."

From the same source it is learned that Union Academy at Belleville, N. Y., has received a gift of $10,000 to establish a department of agricultural instruction.

By a decree of the Minister of Agriculture of France there has been established a Station of Œnology at Toulouse. The director will be J. Vincens.

PERSONAL MENTION.—Dr. Oscar Loew, who for two years past has been connected with the Division of Vegetable Physiology and Pathology of this Department, has been elected professor of agricultural chemistry in the University of Tokyo, Japan, and will enter upon his duties there at once.

Dr. J. Behrens has been chosen director, and has entered upon the duties at the recently established Viticultural Experiment Station at Weinsberg, in Würtemburg.

Dr. O. Mattirolo, professor of botany in the Institute of Florence, has become professor ordinary in botany at the University of Turin.

Dr. F. Cavara, late of the Forest Academy at Vallambrosa, has been chosen professor extraordinary in botany in the University of Cagliari.

Dr. A. Maurizio, of the Experiment Station for Milling in Berlin, has become assistant in botany in the Federal Agricultural Experiment Station at Zürich.

Dr. A. Richter has been chosen director of the Botanical Institute and Gardens at Klausenburg.

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EXPERIMENT STATION RECORD.

Editor: E. W. ALLEN, Ph. D., *Assistant Director.*

EDITORIAL DEPARTMENTS.

Chemistry, Dairy Farming, and Dairying—The Editor and H. W. Lawson.
Meteorology, Fertilizers and Soils (including methods of analysis), and Agricultural Engineering—W. H. Beal.
Botany and Diseases of Plants—Walter H. Evans, Ph. D.
Foods and Animal Production—C. F. Langworthy, Ph. D.
Field Crops—J. I. Schulte.[1]
Entomology and Veterinary Science—E. V. Wilcox, Ph. D.
Horticulture—C. B. Smith and V. A. Clark.
With the cooperation of the scientific divisions of the Department and the Abstract Committee of the Association of Official Agricultural Chemists.

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[1] Absent on leave.

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FERTILIZERS.

FIELD CROPS.

HORTICULTURE.

SEEDS—WEEDS.

DISEASES OF PLANTS.

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EXPERIMENT STATION RECORD.

Vol. XII No. 4.

The exhibits of the agricultural experiment stations of the world at the Paris Exposition considered collectively constituted the most extensive and instructive representation of experiment station work and equipment that has ever been collected. They included contributions from most of the leading countries in which experiment stations are maintained, conspicuous exceptions being Belgium, Canada, Holland, Italy, Sweden, and Switzerland. The impression which might have been made of the magnitude which the experiment station enterprise has assumed during the last decade and of the great diversity of the interests and activities of the stations was largely obscured under the system by which the exhibits were classified. Under this system, or at least under its interpretation, the station exhibits were widely separated, a part placed under "agricultural experiment stations and statistics," a large number under "education," and others in the general agricultural exhibits of their respective countries, while still others were to be found in some of the national buildings. This made it extremely difficult to locate the station exhibits of different countries and well-nigh impossible to find all of the exhibits without reading the entire catalogue of the exposition. This probably accounts for the disparity of the reports brought back by different visitors to the exposition.

For the most part the exhibits were individual rather than collective. The German exhibit was designated a collective one, but was so only in the sense of being brought together in the same space. The exhibit of each station, however, was kept separate from the other, and various commercial displays of apparatus, etc., were installed between the exhibits of individual stations. The stations in the United States had the only strictly collective exhibit, although in the case of several countries the entire exhibit was made by a central station or a ministry of agriculture. There was good opportunity to compare the relative merits of the collective and the individual plans of making exhibits.

The French exhibit as a whole was large, although it did not so impress the observer on account of the individual and scattered plan of installation. Most of the stations were represented in the educational section in connection with the agricultural schools or institutes with which they are affiliated. In addition to photographs of fields,

plats, and stock, plans of buildings, charts, etc., some of the stations showed models of beets grown with different fertilizers, and the sugar and alcohol obtained from them; samples of grains from different sections, and of the soil and rocks of the respective sections; microphotographs of yeasts and bacteria; apparatus for testing agricultural machines, and specimens of plants and seeds grown under various conditions of experiment. A number of pieces of original apparatus were shown, among them Bartmann's apparatus for stirring solutions in six beakers simultaneously, and a filter siphon. The station for agricultural climatology at Juvisy presented a temperature and rainfall record covering two hundred years, beautiful photographs illustrating the classification of clouds, a section of the soil of the plateau of Juvisy, showing 16 strata, and the work of Flammarion on the effect of different colored rays of light on the development of plants. The station for sericulture at Manosque illustrated the culture of silkworms and the work which it is doing in silk production. The investigations of L. Grandeau on the feeding of cab and omnibus horses was illustrated by sample rations, dynamometers, and other apparatus used, and charts. These formed a novel and interesting feature.

The exhibit of the German stations, which was one of the largest in its class, was shown in connection with the general agricultural exhibit of Germany. The handbook of the latter gave a review of the development and present status of the experiment stations in Germany by Professor Nobbe, and a short account of the history, organization, and lines of work of each station, with an enumeration of the material exhibited. This furnished quite complete and systematic data for the German stations, some of the statistics being especially interesting. The total revenue of the 73 stations enumerated is given as 2,244,630 marks, or approximately $94,312, 26.8 per cent of which comes from the general government, 2.6 per cent from the provincial government, 40.7 per cent from agricultural and other societies, and nearly 30 per cent from fees for analysis and control work.

The Moor station at Bremen exhibited several pieces of special apparatus for the investigation of moor soils, such as the determination of substances injurious to plants, absorptive properties, and the free humic acids, and a large collection of photographs showing experiments to test fertilizers and various kinds of physical treatment, the deleterious effects of perchlorate on rye, etc. The photographs illustrating the reclamation of moors were interesting and instructive.

The Darmstadt station showed only photographs illustrating its various pot and field experiments. The Halle station showed apparatus for determining phosphoric acid and nitrogen on a commercial scale, and an interesting set of photographs illustrating the results of vegetation experiments on the question of nitrification in the soil and the treatment of barnyard manure. The station for plant protection

at Halle made an interesting exhibit of apparatus employed in its work, herbaria, specimens, etc.; and the seed-testing station at Hamburg displayed enlarged photographs and samples of weed seeds of different origin which have been found in grass and clover seed. Samples of clover seed from different countries with the several impurities separated were displayed in watch glasses. The experiment station at Kiel showed special apparatus, much of it original, used in the examination of feeding stuffs for composition and purity; and the station at Marburg exhibited Dietrich's apparatus for determining the weathering of soil-producing rocks, and a rather complicated vegetation apparatus for studying the effect of specific bacteria on plant growth. The Möckern station illustrated the Pettenkofer respiration apparatus by means of charts, photographs, and models of parts, and showed the results of experiments on the metabolism of nitrogen, carbon, and energy with oxen. In the same line was an exhibit from the Bonn station of apparatus for collecting the urine and feces in metabolism experiments with cows, and two methods of determining dry matter in feeding stuffs in connection with such experiments. Several pieces of apparatus for soil investigation were shown by the Rostock station, and the agricultural high school at Berlin showed, by means of charts, 60 typical profiles of German soils, together with analyses of the same, and 12 polished marble plates illustrating the solvent action of the roots of a considerable number of common crops. The Tharand station made quite an elaborate display of apparatus for testing seed as to purity and determining their volume, and of the results of vegetation experiments on the action on Leguminosæ of pure cultures of tubercle bacteria, showing by means of photographs the effect of different kinds of nitragin. The exhibits of experimental work in dairying were made by the stations at Kiel and Kleinhof-Tapiau and the dairy institute at Hameln. These included different kinds of apparatus for the examination of milk, separation of constituents, etc., among which were a Renke-Stutzer apparatus for determining the amount of dirt in milk, cultures by Weigmann of bacteria for ripening cream (in liquid and dried form), and a collection of photographs of bacteria isolated from milk, butter, and cheese. There were various charts showing the effect of period of lactation and feeding on the composition of butter fat, and the results of systematic examination of the milk of 63 cows during one or more periods of lactation at Kleinhof-Tapiau.

The various pieces of apparatus displayed in the German exhibit were described as to principle and method of use in the handbook mentioned above. This added much to the interest and to an intelligent understanding of the apparatus, and made possible a more thorough study of the progress in methods of investigation.

The Rothamsted station had a small exhibit which consisted for the

most part of charts and illustrations, samples of wheat grown on soil which had been cultivated continuously in wheat for fifty-six years, together with samples of the soil.

The Japanese stations were represented by thirty-two charts giving the results of experiments with rice, photographs illustrating different operations in rice growing, and a map showing the location of the stations. These stations also made a good exhibit of native food products.

The most prominent feature of the exhibit of the Danish stations was a model of the buildings and grounds of the Royal Veterinary and Agricultural Institute at Copenhagen, which was about 9 feet square. Most of the exhibit came from that institution. It consisted of photomicrographs of milk bacteria and fat globules; a Fjord milk tester; model of an improved ice house; samples of Danish cereals, brewing barley, and soils; a graphic representation of the results of feeding experiments, and a map showing the location of the stations and experimental fields.

The exhibit of the Russian stations formed a part of that of the ministry of agriculture and was in conjunction with that of the agricultural societies. A sample of the chernozem or black soil of Russia, about 18 inches square and 1 meter thick, showed the depth to which the humus or black soil extends, the yellow subsoil just showing at the bottom of the sample. A number of agricultural societies showed samples of grains, vegetables, flours, dairy products, wool, etc., and the laboratory of agricultural bacteriology at St. Petersburg had an interesting exhibit of photographs of cultures and culture tubes showing the application of biology in wine making, dairying, the destruction of rodents, and in soil studies. The station for silkworm culture at Tiflis also made a very interesting exhibit consisting of photographs of the buildings, laboratories, and workrooms, and samples of young mulberry trees and models of trees illustrating the method of pruning. The life history of the different kinds of silkworms was shown, together with samples of the silk and of silk fabrics made at the station. In addition to this the station displayed photographs and models of beehives used for experimental purposes.

The seed-control station at Vienna illustrated its work by models of machinery for cleaning seed, the ordinary apparatus used in seed testing, photographs of laboratories and experimental fields, and a file of its publications and those of the branch stations connected with it.

The exhibit of the Hungarian stations was very creditable, and was especially interesting on account of the general lack of definite knowledge regarding the activity of these stations. The stations interested in viticultural work made a fine display of apparatus, models of buildings and of plants, showing the methods of cultivating and pruning the grape, and photomicrographs showing the anatomical structure of

the vine, the union of grafts on the vine, and ferments found in wine. Spraying apparatus, all of the knapsack type, soils from typical viticultural regions with separations made by the elutriator, and maps, charts, and pictures were also shown.

The ministry of agriculture of Bosnia made a good showing for the stations in that small country. The exhibit consisted of plans and photographs of the stations and their work, specimens showing methods of pruning the vine, varieties of grapes, and other viticultural work.

Mention has been previously made of the general character of the experiment station exhibit of the United States (E. S. R., 11, p. 601). Although it occupied rather an unfortunate location, it was sought out by a considerable number of persons especially interested in agricultural experimentation, and was highly complimented by members of the jury of awards.

As a rule, the station exhibits were quite representative of these institutions, collectively and individually, and brought them into prominent notice as established agencies for the advancement of agricultural science. On account of the extent of the representation and the diversity of the exhibits, there were many features of general interest to experiment station workers and of especial interest to those who have taken an active part in planning and preparing such exhibits in the past. To those who were able to study the methods of display which were followed by different countries, the exhibits furnished some valuable lessons and suggestions which should be helpful in the future.

CHEMISTRY.

The direct determination of available phosphoric acid, F. P. Veitch (*Jour. Amer. Chem. Soc., 21 (1899), No. 12, pp. 1090–1094*).—The author investigated the cause of the discrepancy between results obtained by the Ross direct method,[1] and the official method, and found it to be due to the fact that no account was taken in the Ross method of the phosphoric acid removed in the water used in washing the citrate-insoluble residue. Tests were made of the citrate and molybdate methods for the direct determination of available phosphoric acid with results very favorable to the latter method, which was carried out as follows: "The water-soluble, extracted as usual, was received in a 500 cc. flask, graduated roughly at 250 cc. and containing 5 to 10 cc. nitric acid. The citrate-soluble was then extracted as usual, the filtrate and washings received in the flasks with the water-soluble. After cooling, the volume was completed, shaken, filtered, and in aliquots of 100 cc. the phosphoric acid was determined . . . the molybdate solution being added directly to the solution without destroying the organic matter, but the precipitates were allowed to stand over night before filtering. The determinations were completed as usual."

Note upon the determination of nitrogen in fertilizers containing nitrates, F. P. Veitch (*Jour. Amer. Chem. Soc., 21 (1899), No. 12, pp. 1094, 1095*).—The following modification of the Fields-Gunning method[2] has been used by the author with very satisfactory results: "To the nitrate in the digesting flask are added 35 to 40 cc. sulphuric acid containing 34 gm. salicylic acid per liter. Allow to stand in the cold until the nitrate is dissolved. Add 6 or 7 gm. of finely broken potassium sulphid, heat over a low flame for 15 minutes, then over the full flame until clear. Cool and distil as usual."

The gasometric measurement of nitrites in the presence of nitrates or other soluble salts, J. Gailhat (*Jour. Pharm. et Chim., 6. ser., 12 (1900), No. 1, pp. 9–12; abs. in Chem. News, 82 (1900), No. 2126, pp. 87, 88*). The method proposed is based upon the fact that when a solution of neutral metallic nitrite is added to an excess of neu-

[1] U. S. Dept. Agr., Division of Chemistry Bul. 38, p. 17.

[2] Jour. Amer. Chem. Soc., 18 (1896), p. 1102 (E. S. R., 8, p. 663).

tral, boiling, concentrated solution of ammonium chlorid a regular disengagement of nitrogen takes place according to the following formula: $NH_4Cl+NO_2M^1=N_2+2H_2O+M^1Cl$. The nitrite is estimated either from the amount of nitrogen given off or of ammonium chlorid decomposed. The author considers the former method preferable. He uses for the collection and measurement of the nitrogen a modification of Schloesing's apparatus for the determination of nitrates.

The distillation of ammonia in the determination of nitrogen, F. G. Benedict (*Jour. Amer. Chem. Soc., 22 (1900), No. 5, pp. 259–263, fig. 1*).—The essential feature of the method proposed consists in distilling the liquid through a condenser surrounded by cold water, which is allowed to run out a few minutes before the end of the distillation, so that the condenser tubes may become heated and the ammonia driven out of them by a current of live steam. In this way about 20 minutes' distillation suffices to drive over all of the ammonia. A form of distillation apparatus adapted to this method is described.

Lime and sulphuric acid by the photometric method, J. I. D. Hinds (*Jour. Amer. Chem. Soc., 22 (1900), No. 5, pp. 269–274*).—In this method (E. S. R., 8, pp. 201, 202) lime is precipitated in the solution to be tested with solid calcium oxalate and sulphuric acid with solid barium chlorid. A cylinder 3.5 cm. wide and 20 cm. high, graduated in centimeters and millimeters, is held over a sperm or wax candle and the water containing the precipitate is poured into it until the image of the flame just disappears. The depth in the cylinder is read and the percentage is calculated from equations or read from tables which are given in the article.

The estimation of fat in sweetened condensed milk by the Babcock test, E. H. Farrington (*Amer. Chem. Jour., 22 (1900), No. 3, pp. 267–270*).—In testing sweetened condensed milk by the Babcock test the excess of cane sugar causes a poor separation of the fat, preventing a satisfactory reading. The author finds that the sugar can be washed out without removing any of the fat. In making the test, preferably 60 gm. of condensed milk is dissolved in 100 cc. of water, the volume made to 200 cc., and 17.6 cc. of this solution mixed in a Babcock test bottle with about 3 cc. of the sulphuric acid commonly used for testing milk. The bottle is whirled for about 6 minutes in a turbine centrifuge heated to about 200° F., in order to compact the curd into a firm lump. The whey containing the sugar is poured off, 10 cc. of water added to the curd and 3 cc. of acid, and the whirling repeated. After pouring off the whey a second time the curd is mixed with 10 cc. of water and 17.5 cc. of sulphuric acid, and the test then made as usual. "Careful tests of the whey poured off from the test bottles showed that no fat was lost by this decantation if the whey was clear and contained no pieces of curd." The results of tests of a number of samples by this method are reported.

A new method of ash determination, A. E. SHUTTLEWORTH (*Ontario Agr. Col. and Expt. Farm Rpt. 1899, pp. 42-44, figs. 4*).—This relates to the use of acetate of lime to prevent the formation of indecomposable silicates, and the author's platinum apparatus (E. S. R., 11, p. 304).

Contribution to the knowledge of metaphosphate, G. VON KNORRE (*Ztschr. Anorgan. Chem., 24 (1900), p. 369; abs. in Chem. Ztg., 24 (1900), No. 66, Repert., p. 233*).—The author concludes from his investigations that all of the five known modifications of metaphosphate may be represented by the formulas $(R^{I}PO_3)_n$ and $(R^{II}P_2O_6)_n$, all combinations containing 1 molecule each of base and phosphoric anhydrid.

A process for preventing the reversion of soluble phosphoric acid in superphosphates dried by heat by means of compressed air or a current of air (*L'Engrais, 15 (1900), No. 30, p. 712*).—A brief note is given on a process patented by J. Lüjens.

Determination of nitrous acid, G. ROMIJN (*Chem. Ztg., 24 (1900), No. 15, pp. 145, 146*).

Critical studies on the more important reagents for the detection of nitric acid in water, H. MENNICKE (*Ztschr. Angew. Chem., 1900, No. 29, pp. 711-719; abs. in Chem. Centbl., 1900, II, No. 7, p. 444*).—After testing numerous methods the author gives preference to Erdmann's method (E. S. R., 12, p. 18).

On the determination of perchlorate in nitrate of soda, C. AHRENS and P. HETT (*Ztschr. Angew. Chem., 1900, No. 17, p. 419*).—A denial of Woy's statement[1] that platinum dishes are injured by use in the determination of perchlorates by the author's method (E. S. R., 11, p. 110).

The determination of iodic acid in nitrate of soda, M. R. AUZENAT (*Rev. Chim. Analyt. et Appl., 5 (1900), No. 3, pp. 84, 85*).—The limited application of Beckurts' and Rammelsberg's methods is noted. By a slight modification of the latter method the disturbing influence of potassium perchlorate is avoided. The method consists of comparing the color produced by the liberation of the iodin with that produced by a solution containing a known amount of potassium iodid. Complete directions are given as to manipulation.—H. SNYDER.

The estimation of chlorin in bleaching powder, C. WOLOWSKI (*Ztschr. Analyt. Chem., 38 (1899), No. 11, pp. 711-713*).

The titration of normal acids, H. THIELE and R. RICHTER (*Ztschr. Angew. Chem., 1900, No. 20, pp. 486-489*).

On the use of succinic acid in alkalimetry, E. PETERSEN (*Ztschr. Angew. Chem., 1900, No. 28, p. 688*).

The elementary analysis of organic substances containing water, F. G. BENEDICT (*Amer. Chem. Jour., 23 (1900), No. 4, pp. 334-352*).

Chemical studies on the extraction of fatty substances by means of carbon bisulphid, L. FABRE (*Oesterr. Chem. Ztg., 3 (1900), No. 15, pp. 370, 371*).

An examination of Brown and Taylor's official method of identifying butter, J. A. HUMMEL (*Jour. Amer. Chem. Soc., 22 (1900), No. 6, pp. 327-329, pls. 2*).—The author has successfully employed this method in testing for renovated butter. "In every case the normal butters gave with the selenite which was used a uniformly blue-colored field, showing the entire absence of fat crystals. The renovated butters on the other hand gave a blue field mottled with yellow; this mottled appearance varied slightly in intensity, but was very marked and distinctive in every case."

The chemistry of corn oil, H. T. VULTE and H. W. GIBSON (*Jour. Amer. Chem. Soc., 22 (1900), No. 8, pp. 453-467*). The chemical and physical constants were determined for 3 samples of corn oil.

On the rancidity of fats, I. NAGEL (*Amer. Chem. Jour., 23 (1900), No. 2, pp. 173-176*).—The rancidity of fats and the refining of rancid oils and fats.

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[1] Ztschr. Angew. Chem., 1900, No. 15, p. 382.

On cellulose and starch, Z. H. Skraup (*Ber. Deut. Chem. Gesell.*, *32* (*1899*), *p. 2413; abs. in Bul. Soc. Chim. Paris, 3. ser., 23* (*1900*), *No. 13, pp. 619, 620*).

On cellulose, G. Bumcke and R. Wolffenstein (*Ber. Deut. Chem. Gesell.*, *32* (*1899*), *pp. 2493–2507; abs. in Bul. Soc. Chim. Paris, 3. ser.*, *23* (*1900*), *No. 13, p. 620*).

Researches on the oxycelluloses, O. von Faber and B. Tollens (*Ber. Deut. Chem. Gesell.*, *32* (*1899*), *pp. 2589–2601; abs. in Bul. Soc. Chim. Paris, 3. ser*, *23* (*1900*), *No. 13, p. 621*).

On the presence of dextrose and levulose in the leaves of beets, L. Lindet (*Bul. Soc. Chim. Paris, 3. ser.*, *23* (*1900*), *No. 12, pp. 544–549*).

A method for the determination of the melting point, M. Kuhara and M. Chikashigé (*Chem. News*, *80* (*1899*), *No. 2089, pp. 270, 271, fig. 1*).

Liquid air as an analytical agent, Dewar (*Chem. News*, *80* (*1899*), *Nos. 2082; pp. 187–190, figs. 2; 2083, pp. 199–202, figs. 2; 2084, pp. 212, 213, figs. 3*).

Some new laboratory apparatus, M. Kaehler and Martini (*Ztschr. Angew. Chem.*, *1900, No. 21, pp. 518, 519, figs. 5*).—Descriptions are given of E. A. Taylor's modification of Soxhlet's extraction apparatus for determining fat in solutions and of the apparatus for the determination of nitrogen according to Kjeldahl, a new water pressure pump, and a modification of Sonnenschein's gas blast lamp.

Apparatus for fat extraction, R. Frühling (*Ztschr. Angew. Chem.*, *1900, No. 11, p. 270, fig. 1*).—A description of an apparatus in which mercury seals are used instead of cork.

Absorption apparatus for elementary organic analysis, F. G. Benedict (*Amer. Chem. Jour.*, *23* (*1900*), *No. 4, pp. 323–354, figs. 2*).

An improved Gooch crucible, W. C. Heraeus (*Ztschr. Angew. Chem.*, *1900, No. 30, p. 745*).—This is a note on H. Neubauer's recommendation to use a layer of platinum sponge instead of asbestos in the Gooch crucible.

A convenient laboratory apparatus for the generation of gases, N. J. Lane (*Jour. Soc. Chem. Ind.*, *19* (*1900*), *No. 1, p. 14*).

A simple filter press for laboratory use, W. von Loeben (*Chem. Ztg.*, *24* (*1900*), *No. 19, p. 193, fig. 1*).

New form of water-bath regulator, H. S. Hatfield (*Chem. News*, *81* (*1900*), *No. 2098, p. 65, fig. 1*).

BOTANY.

The migration of food material in leaves, G. M. Tucker and B. Tollens (*Ber. Deut. Chem. Gesell.*, *32* (*1899*), *pp. 2575–2583; abs. in Jour. Roy. Micros. Soc.* [*London*], *1900, No. 2, p. 220*). In the case of leaves of the plane tree, the weight of the ash is said to increase until the death of the leaves, and then slightly decline. The same is the case with silica and lime content, but chlorin and sulphuric acid show a continuous increase. Leaves gathered in November contain 3 times as much sulphuric acid as leaves gathered in June. Phosphoric acid and potash increase slightly until the death of the leaves, after which they diminish to less than one-half their original quantity. The amount of nitrogen decreases continually to less than one-fourth its original quantity. There appears to be but little retrogression of food materials from the leaves to the stem or branches. Rain, it is said, has little if any washing-out action on the food material in the leaves.

A contribution to the knowledge of arginin, U. Suzuki (*Bul. Col. Agr. Tokyo, 4 (1900), No. 1, pp. 68, dgms. 6*).—The author has made a study of the seeds and shoots of a number of Japanese plants in order to investigate the question of the presence, formation, and transformation of arginin and its relation to the regeneration of proteids and the influence of light and other agents upon these processes. The seeds and shoots of *Cryptomeria japonica*, *Gingko biloba*, and *Pinus thunbergii* were investigated and arginin isolated from them. It was found that the proteids prepared from the seeds of these plants produced, under the action of dilute acids, a considerable quantity of organic bases, the chief of which was arginin. This is particularly abundant in the etiolated shoots of Cryptomeria and Pinus and exists in a small quantity in the shoots of Gingko. The chemical nature of the proteids examined in both the shoots and seeds is considered identical as they gave the same decomposition products.

In the second portion of the paper the author reports investigations of the synthetical formation of arginin; the effect of light and mineral nutriment upon its formation and transformation, studying not only coniferous plants but a number of others. It was found that arginin in coniferous plants is not only the result of a decomposition of proteids but can be synthetically formed from ammonium salts and also probably from nitrates. Those plants not belonging to the Coniferæ which were examined were unable to produce arginin by the assimilation of ammonium salts, asparagin being their only product. The synthetical formation of arginin took place equally well in diffused and bright sunlight. Whether it is formed in darkness is as yet undetermined. It was found to accumulate in large quantities in the shoots of Coniferæ in the dark as well as in daylight during the first stages of germination but the amount diminishes on further exposure to light. Its transformation into proteids may be accelerated under the influence of light by the addition of mineral nutrients. While the greater part of arginin is believed to come from reserve proteids by hydrolytic decomposition, a considerable portion is thought to come from the transformation of other amido compounds. Consequently it is not only a primary but a secondary product.

Synthesis of albuminoids, W. Palladin (*Charkow, 1898; abs. in Jour. Roy. Micros. Soc. [London], 1900, No. 2, p. 223*).—In addition to the intermediate products of the primary synthesis of albuminoids, it is said that there are products of the decomposition of albuminoids, intermediate products of the regeneration of the decomposition products, and various special products of the breaking up of the albuminoids. The decomposition of albuminoids takes place only in growing organs. In *Ulva lactuca* and *Enteromorpha intestinalis*, asparagin was found, but no tyrosin. From this it is stated that the first stage in the primary synthesis of albumen can not be tyrosin. Asparagin and

tyrosin are both considered simple products of the decomposition of albuminoids. In *Salicornia herbacea* neither asparagin nor tyrosin was found. In the leaves of *Robinia pseudacacia* there was present small amounts of asparagin but no tyrosin, while in the leaves of *Dahlia variabilis* in August neither asparagin nor tyrosin was present.

A contribution to the study of nitrogen assimilation by legumes, LUTOSLAWSKI (*Centbl. Agr., 1899, Oct., p. 688; abs. in Ann. Agron., 26 (1900), No. 8, pp. 415, 416*).—An attempt was made to study the fixation of nitrogen by leguminous plants at different stages of their growth. The plants selected for the experiment were peas, and were grown in pots which contained 6 kg. of soil from a field where peas had been grown the previous year. Mineral fertilizer composed of kainit, superphosphate and nitrate of soda, 1.277 gm. per pot, was added to the soil. The different phases of growth recognized were (1) from the beginning of germination until the period just preceding flowering, at which time the plants bore from 8 to 10 leaves; (2) at the beginning of flowering; (3) at full flower; (4) at the falling of the flowers; and (5) at maturity. The total increase for the peas grown in pots receiving no nitrogenous fertilizer for the different periods was 1, 1.65, 3.14, 5.17, and 3.40 per cent. The corresponding numbers for the peas which had received nitrogenous fertilizers were 0.145, 1.89, 2.95, and 2.20 per cent, the ability to assimilate nitrogen in the case of the plants receiving fertilizers not having manifested itself in the first period.

Further observations on the nature and functions of the nodules of leguminous plants, MARIA DAWSON (*Phil. Trans. Roy. Soc.* [*London*], *1900, pp. 51–67, pls. 2; abs. in Proc. Roy. Soc.* [*London*], *66 (1900), No. 425, pp. 63–65*).—In continuation of a previous paper (E. S. R., 11, p. 25), the author reports on the morphology and nature of the organisms occurring in the root tubercles of a number of species of leguminous plants.

A further study of the morphology leads to the conclusion that no definite line of distinction can be drawn between genera in which filaments occur in tubercles and those in which they have not yet been observed. Some peculiar anatomical characters were noted in some of the tubercles, which are to be studied further. In the study of the organisms of *Desmodium gyrans* it was ascertained that the formation of X and Y forms arises by distinct lateral branching of the straight rods. After 12 to 14 days' culture, the individual long rods tend to break up into small ones, and the branched forms become disjointed in a similar manner.

A general study of these organisms and parallel cultures of Nitragin compared with pure cultures from Pisum tubercles shows that they all grow readily on gelatin or agar media containing an extract of pea stems, asparagin, and sugar, but very slowly on broth gelatin. They

do not peptonize milk, but upon potatoes a watery streak is formed in about 5 days. In liquid media, such as pea extract, a thick zooglœa-like film forms in from 12 to 14 days. The presence or absence of spores in these films is now under investigation. The organisms are aërobic, and may pass through a short motile stage, but the presence of cilia has not yet been demonstrated. Investigations are now in progress to determine whether these organisms are in themselves capable of fixing free nitrogen or of converting nitrogen in the form of ammonium salts into nitrites or nitrates.

Experiments made to determine the action of the organisms found in one genus of plants on specimens of another tribe or genus suggest that there is probably but one organism capable of producing tubercles on leguminous plants, but that in each particular host special physiological conditions exist to which the organisms become so especially adapted as to make it difficult for successful reciprocal action to take place between plants not nearly allied.

Experimental cultures in sterilized and unsterilized media indicate best results when nitrates without organisms are supplied to the plants in sterilized soil. In unsterilized media a small increase in crop may result from the use of Nitragin.

An experiment with inoculating soy beans, C. B. LANE (*New Jersey Stas. Rpt. 1899, pp. 199, 200*).—An experiment with soy beans was begun in 1896, in which 1 acre of wheat was followed two succeeding seasons with soy beans. The roots of the plants were examined from time to time but no tubercles found. The third season an attempt was made to introduce the germs of the soy-bean tubercle by adding soil from old soy-bean land and by adding dust from the floor where soy beans had been threshed. Examinations were made of the plants and abundant tubercles were found on both the inoculated plats, and a few scattering ones, or frequently none at all, on the untreated ones.

The results of this experiment show the practicability of transferring the tubercle organism through means of soil or dust.

An annotated catalogue of the ferns and flowering plants of Oklahoma, E. E. BOGUE (*Oklahoma Sta. Bul. 45, pp. 48*).—This bulletin gives a list of 750 species of plants, together with brief notes on their distribution and economic importance.

Native Oklahoma plants, E. E. BOGUE (*Oklahoma Sta. Bul. 45, popular ed., pp. 12*).—A popular edition of Bulletin 45 of this station, giving notes on the distribution of the plants throughout the Territory.

Notes on plants of 1899, F. L. HARVEY (*Maine Sta. Bul. 61, pp. 43, 44*).—Brief notes are given on a dozen species of weeds and other plants sent to this station for identification.

Root systems of farm crops, A. M. SOULE (*Tennessee Sta. Rpt. 1899, pp. 42–45, figs. 4*).—Notes are given on the development and distribution of the roots of maize in the soil.

Investigations on cleistogamous flowers, LECLERC DU SABLON (*Rev. Gén. Bot., 12 (1900), No. 140, pp. 305–318, figs. 18*).—Studies are given on the structure and

fertilization of the cleistogamous flowers of *Viola odorata*, *Oxalis acetosella*, *Linaria spuria*, and *Leersia oryzoides*.

A contribution to the life history of Quercus, A. H. Conrad (*Bot. Gaz., 29 (1900), No. 6, pp. 408–418, pls. 2*).

The life history of flax and clover dodder, G. Wilsdorf (*Fühling's Landw. Ztg., 48 (1899), Nos. 14, pp. 544–550; 15, pp. 561–567*).—Studies are reported on the germination; experiments on dodder seedlings, with reference to the host plant; the haustoria and methods of attack, and growth and reproduction of the dodder.

A study of the leaf of the sugar beet at different periods of growth, P. Wendeler (*Deut. Zuckerind., 25 (1900), No. 24, pp. 969–971*).—Shows the content of oxalic acid, total nitrogen, and proteid nitrogen.

Plant growth in oil, L. Lutz (*Bul. Soc. Bot. France, 3. ser., 47 (1900), No. 2–3, pp. 76–82, fig. 1*).—An account is given of the growth of a number of fungi in castor oil and in vaseline. *Aspergillus repens* made a remarkable growth in both media.

Transpiration of evergreen leaves, O. Rosenberg (*Öfvers. K. Svenska Vetensk. Akad. Förhandl., 1900, No. 1, pp. 85–98*).

The utilization of the reserve materials of seeds during germination, Mazé (*Compt. Rend. Acad. Sci. Paris, 130 (1900), No. 7, pp. 424–427*).—Briefly outlines investigations on starchy and oleaginous seeds. The reserve materials of both are transformed into sugar for translocation. Enzyms are said to vary little in quantity between the third and sixth day of germination, and a temperature of 53° C. is the optimum for their activity.

The carbohydrate reserve of white clover seed, H. Hérissey (*Compt. Rend. Acad. Sci. Paris, 130 (1900), No. 25, pp. 1719–1721*).—The carbohydrate reserve material in the seeds of *Trifolium repens* is said to be a mannogalactan, the properties of which resemble those exhibited in the reserve material of fenugreek and alfalfa seed. It is hydrolyzed by seminase, being at least partially transformed into reducing sugars.

Physiological observations on some perennial herbs, A. Rimbach (*Bot. Gaz., 30 (1900), No. 3, pp. 171–188, pl. 1*).—Notes are given on the underground structures and their development of a considerable number of perennial herbs.

On the absorption of soluble salts by plants, E. Demoussy (*Thesis, Paris, 1899; noted from Ann. Agron., 25 (1899), Nos. 11, pp. 497–548; 12, pp. 561–607*).—See E. S. R., 11, p. 1009.

On the presence of formaldehyde in plants, G. Pollacci (*Rend. R. Inst. Lombardo Sci. e Let., 2. ser., 32 (1899), pp. 4; abs. in Bot. Centbl., 82 (1900), No. 4, p. 116*).—Tests of green leaves of a number of species of plants are reported in which formaldehyde was found in the chorophyll-bearing tissues when they had been exposed to the light.

Physiological investigations of inulase and inulin, A. Richaud (*Thesis, Paris, 1900, pp. 85*).

Photosynthesis in light which has traversed leaves, E. Griffon (*Rev. Gén. Bot., 12 (1900), Nos. 138, pp. 209–223; 139, pp. 272–288*).—This paper gives the details of investigations on the effect of light made to pass through leaves on photosynthesis, a preliminary account of which has already been given (E. S. R., 11, p. 1010).

A chemical study of chlorophyll assimilation, S. Posternak (*Rev. Gén. Bot., 12 (1900), Nos. 133, pp. 5–24; 134, pp. 64–73*).—Discusses the first product produced from phosphoric acid in green plants and the physiological rôle of inosite.

Phyllorubin, a new derivative of chlorophyll, L. Marchlewski (*Anz. Akad. Wiss. Krakau, 1900, No. 2, pp. 63, 64*).

Experimental investigations on the hydrolysis and utilization of raffinose by Penicillium glaucum, H. Gillot (*Bul. Acad. Roy. Sci. Belg., 1900, No. 2, pp. 31*).

On the stimulating effect of certain substances upon the growth of algæ and fungi, N. ONO (*Bot. Mag. [Tokyo], 15 (1900), No. 160, pp. 75–78*).

The importance of mycorrhiza, a comparative biological study, E. STAHL (*Jahrb. Wiss. Bot., 34 (1900), No. 4, pp. 539–688, figs. 2*).

Origin of the Basidiomycetes, G. MASSEE (*Jour. Linn. Soc. Bot. [London], 34 (1900), No. 240, pp. 438–448, pls. 2*).—Notes on the morphology and affinities of this group of fungi.

The nodule organism of the Leguminoseæ, R. G. SMITH (*Proc. Linn. Soc. New South Wales, 24 (1900), No. 96, pp. 653–674, pls. 2*).—A history of the organism and the results of the researches of the writer.

METEOROLOGY.

Frost fighting, A. G. MCADIE (*U. S. Dept. Agr., Weather Bureau Bul. 29, pp. 15, pls. 6*).—This is a discussion of the methods of forecasting and protecting against frost, especially as practiced among the fruit growers of California. "The experience of the past 3 years warrants the statement that the loss due to frosts in California, hitherto considered unavoidable, can be prevented, and that unless extreme conditions, by which is meant lower temperatures by 5° than have ever yet been experienced in this State, occur, the citrus fruits of California can be successfully carried through the period when frost is likely." It is claimed that "the formation of frost is primarily a matter of air drainage," and fruit growers are urged to study the topography of their lands with a view to locating the areas over which the air is stagnant and consequently more subject to frost.

Attention is called to the following important relation, first pointed out by Prof. W. H. Hammon, which is useful in forecasting frosts for southern California: "A wave of falling pressure passes from Montana or Idaho southward across Utah and westward through southern Nevada, thence into Arizona or southern California, and if followed by a rapid rise in pressure is generally the forerunner of much colder weather in the southern citrus belt. . . . The Weather Bureau office at San Francisco has demonstrated beyond criticism that frost can be successfully forecast." A study of the frost warnings of the Bureau, with frequent observations on temperature, humidity, and air motion, will enable the grower to judge of the danger of frost in his particular case. The methods of protection discussed are, planting with more regard to air drainage and correcting defective air drainage by means of windbreaks, etc.; warming the air by means of small fires in wire baskets, smudging and the use of steam, irrigation with unheated and with warm water, spraying, and screening or covering. Many of these methods have proved of great practical value, but "of all methods proposed for the protection of fruit, excepting wire baskets, irrigation has the largest amount of evidence in its favor."

Prediction of frost, J. E. BONEBRIGHT (*Idaho Sta. Bul. 23, pp. 136–142, figs. 3*).—This article discusses briefly protection against

frosts by means of smudges, and describes a piece of electrical apparatus devised by the author to give warning of a fall in temperature.

"The apparatus consists of a battery, relay coil, alarm bell, and thermometer. The battery used is the common crow-foot cell used in telegraphing, size 6 in. by 8 in.

"The relay C (fig. 4) is composed of two coils. Each coil has an iron core 1¼ in. long, ¼ in. in diameter, and is wound with No. 24 B. and S. double cotton-covered magnetic wire, to a depth of ¼ of an inch. The coils are wound right and left handed and are placed horizontally.

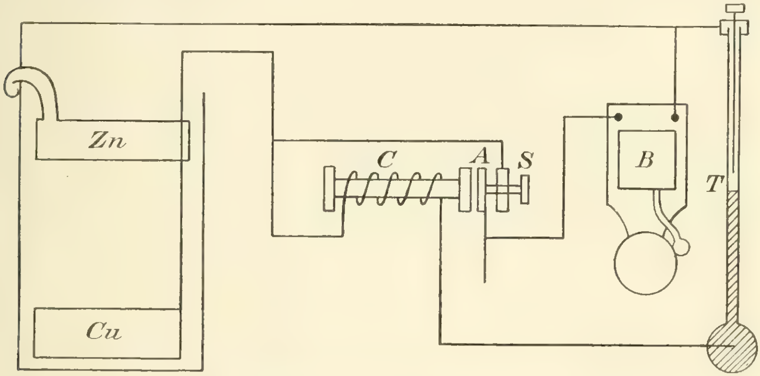

FIG. 4.—Electrical apparatus for frost warning.

"The armature A consists of an upright piece with a crossbar of soft iron, which is so held that it is attracted by the iron cores of the coils when magnetized. An adjustable spring holds the armature A against the screw S when no current is flowing through the coil C. . . .

"The thermometer consists of a glass stem 8 or 10 in. long, with an internal diameter of approximately $\frac{1}{25}$ of an inch (0.1 cm.), attached to a bulb which has a diameter of 1 in. (2.5 cm.). The bulb and 2 or 3 ins. of the lower part of the tube are filled with mercury, and the tube is graduated for every 10 degrees from 30° F. to 100° F. Electrical connection with the mercury is made by a platinum wire blown in the glass. On the top of the stem is a brass cap with a No. 30 B. and S. bare copper wire passing through it and making contact with the mercury. The thermometer can be tested at any time by comparing it with an accurate Fahrenheit thermometer. It is made large in order to give free action to the mercury around the wire in the tube. . . .

"The thermometer should be freely exposed, not more than 2 or 3 ft. above the ground, in that portion of the orchard most liable to frost, usually the lower ground.

"The lower point of the copper wire in the tube of the thermometer should be set opposite the number indicating the temperature for which the instrument is to give warning, usually 40 to 45° F. A copper wire, No. 16 B. and S., connects the wire in the stem of the thermometer to one post of the bell and to one pole of the battery, another wire connects the mercury in the bulb with the proper binding post of the coil, and a third wire is run from the armature of the relay to the remaining binding post of the bell. The remaining pole of the battery is then connected to the properly marked post of the coil. . . .

"The action of the instrument is very simple. When the wire in the stem of the thermometer is in contact with the mercury a current of electricity will pass through the relay coils, causing the armature to be attached to the iron cores. The battery

furnishes a continuous current and will keep the armature in this position until the circuit is broken. When the circuit is broken by the mercury falling below the lower point of the wire in the thermometer the armature will be drawn by the spring against the screw S, which puts the bell in a circuit with the battery."

The use of the ordinary differential thermometer in the above apparatus is explained and one form of thermostat is described, but thermostats are not considered reliable for the purpose of frost warnings.

A study on hail. Protection of crops by cannonading, V. VERMOREL (*Étude sur la grêle. Défense des récoltes par le tir du canon. Montpellier: Coulet & Sons, 1900, pp. 78, figs. 14*).—This pamphlet discusses the various theories of the formation of hail, the explosives and cannon used and how the explosions operate to prevent hail, the results obtained in different countries, and the organization of stations; and gives the statutes of the cantons of Villefranche and Anse against hail, and titles of 103 papers on the subject. The author claims the results already obtained conclusively prove the effectiveness of this means of preventing destructive hailstorms. The detailed results of numerous experiments are reserved for a future publication.

Meteorological records, J. E. BONEBRIGHT (*Idaho Sta. Bul. 23, pp. 129–133*).—Monthly and yearly summaries of observations at Moscow, Idaho, on temperature, pressure, precipitation, cloudiness, and dates of latest frosts in spring and earliest in autumn during 1898 and 1899; and a summary of similar observations during 5 years (1895–1899).

The mean temperature for 1899 was 44.8° F., for the 5 years (1895–1899) 45.1°; the highest temperature for 5 years was 100°, the lowest −17°. The mean pressure for 1899 was 27.25 in., for 5 years 27.33. The rainfall in 1899 was 20.12 in., melted snow 3.35 in.; during 5 years 19.02 and 4.37 in. respectively. The average number of clear days (per year) during 5 years was 180, during 1899 171. The latest killing frost in the spring occurred May 17, the earliest in the fall October 2, in 1899; the latest frost in spring during 5 years occurred May 30, 1898, the earliest in the fall September 6, 1895.

Meteorological observations, J. E. OSTRANDER and A. C. MONAHAN (*Massachusetts Hatch Sta. Met. Buls. 136, 137, 138, pp. 4 each*).—Summaries of observations on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during April, May, and June. The data are briefly discussed in general notes on the weather of each month.

Report of precipitation and temperatures for the year 1899, J. B. REYNOLDS (*Ontario Agr. Col. and Expt. Farm Rpt. 1899, pp. 28, 29*).—A monthly summary of observations at Guelph. "The highest temperature recorded at the college for the year was 95° on August 19. The lowest was 20.5° below zero on February 12. The amount of precipitation for the year, including rain and melted snow, was very nearly 20 in."

Monthly summaries of meteorological observations made at Leon (Guanajuata) during 20 years, 1878-1897, M. LEAL (*Mem. y Rev. Soc. Cient. "Antonio Alzate," 14 (1899–1900), No. 6, p. 264*).—A summary of observations on pressure, temperature, rainfall, evaporation, humidity, cloudiness, direction and velocity of the wind, etc.

Some facts about the climate of Tennessee, W. M. FULTON (*Tennessee Sta. Bul. Vol. XIII, No. 1, pp. 13–16, charts 2*).—This article discusses briefly temperature, rainfall, and length of the growing season in different parts of the State.

The climate of our new possessions, G. Michaud (*Sci. Amer., 83 (1900), No. 11, p. 171, dgms. 2*).

Frost protection, W. M. Fulton (*Tennessee Sta. Bul. Vol. XIII, No. 1, pp. 3–12, figs. 5*).—A popular discussion of how frost is formed and when to expect it, and a description of various methods of protection from frost.

Protection from lightning, J. B. Reynolds (*Ontario Agr. Col. and Expt. Farm Rpt. 1899, pp. 27, 28*).—Statistics of destruction of property and loss of life from lightning during a storm in August, 1899, are briefly summarized, and means of protection are discussed.

Observations on the determinations of drought intensity, G. H. Knibbs (*Jour. and Proc. Roy. Soc., New South Wales, 33 (1899), pp. 69–85, fig. 1*).—A discussion of the conditions affecting soil moisture, rainfall, percolation, evaporation, etc.

Suggestions for depicting diagrammatically the character of seasons as regards rainfall, and especially that of droughts, H. Deane (*Jour. and Proc. Roy. Soc., New South Wales, 33 (1899), pp. 63–68, pl. 1*).—The author briefly describes a diagram which shows not only the total yearly rainfall and its distribution by months, but also "what portion of the rainfall runs off the ground or soaks away and is available for storage and for keeping up the flow of rivers and streams."

Combination of the effects of synodic and tropic revolutions of the moon, its action on the movement of lows, A. Poincaré (*Compt. Rend. Acad. Sci. Paris, 131 (1900), No. 2, pp. 132–135*.

WATER—SOILS.

The soils of Salt Lake Valley, Utah, F. D. Gardner and J. Stewart (*U. S. Dept. Agr., Division of Soils Circ. 4, pp. 11*).—This is a preliminary report on a survey undertaken in July, 1899, by the Division of Soils, cooperating with the Utah Station, to map the soils with particular reference to the extent of and damage from alkali and seepage waters.

A brief account is given of early irrigation in this region and of recent irrigation improvements and the results of 4 months' study of the region are briefly summarized under the following heads: Climate, water supply, soil, alkali, and drainage.

A large portion of the area examined is unfit for cultivation on account of excess of alkali salts.

"Sodium chlorid, or the common salt of commerce, forms from 50 to 97 per cent of the total salts present. Besides this, there are considerable quantities of the sulphates of soda, lime, and magnesia, chlorids of lime and magnesia, and also carbonate of soda, or true black alkali. The black alkali is nearly always present in amounts varying from a trace up to several per cent in small local spots. There is, in the aggregate, a large area in which it occurs in sufficient quantity (0.1 per cent) to be fatal to crops.

"It seems quite probable that this accumulation of salt came chiefly from two sources, i. e., from the higher lands to the south and from the waters of Great Salt Lake. It is most likely that the lake is the source of the greater portion of them, for when it was from 30 to 50 ft. higher than now, it would have submerged nearly all the area under consideration, and must have also contained much salt in solution. Upon the subsidence of the water the soil would, of course, be left heavily impregnated with salts. Besides, within the memory of the present inhabitants,

the lake has again submerged a considerable part of this area, and, according to reliable records, the lake in 1868 was 12 ft. above its present level, and at this height must have covered at least 50 sq. miles of what is now mapped as dry land. . . .

"There is only one feasible way of getting rid of the salts, and that is by providing a thorough system of underdrainage and washing them out by flooding. . . .

"Of the 125 sq. miles lying mostly north of Twelfth street road and between Salt Lake City and the lake, 90 sq. miles, or about 58,000 acres, are capable of reclamation. For this portion, tile drainage is recommended as of general application."

Some observations on soil temperatures, J. B. REYNOLDS (*Ontario Agr. Col. and Expt. Farm Rpt. 1899, p. 26, fig. 1*).—The method of observation and the results obtained are thus described:

"Some soils in large pans were set in the open air, near a large body of water, and the temperatures of the soils, the air, and the water were observed each hour, beginning at 7 a. m. and concluding at 6 p. m. They were all exposed to the action of the sun's rays. The [temperature of] water rose from 61 to 68°, reaching 68° F. at 2 p. m. It then fell to 66° by 6 p. m. The [temperature of] air rose from 44 to 70°, reaching its highest at 2 p. m., and then fell by 6 o'clock to 63.5°. The soils all began at the same temperature as the air, namely, 44°; all the soils reached their maximum at 1 o'clock, and from that time declined rapidly. The highest temperature reached by the dark soil was 94°, by the light-colored soil 91°, and by the wet soil 80°."

The practical application of these results is briefly discussed.

Analyses of calcareous soils of Monferrato. New methods of determining easily soluble calcium carbonate, F. MARTINOTTI (*Staz. Sper. Agr. Ital., 33 (1900), No. 3, pp. 259–273; abs. in Chem. Centbl., 1900, II, No. 10, p. 593*).—The author reports determinations of moisture, organic matter, sand, clay, citrate-soluble, and total lime in 25 samples of soils, as well as tests of various citrate methods of determining the solubility of crystallized and amorphous calcium carbonate. On the basis of the results obtained he recommends the use of the neutral ammonium citrate solution for the latter purpose. For the determination of clay and sand he recommends a modified form of the Schöne apparatus, which is continuous and automatic in its operation. The adaptability of the soils examined to the American grape is discussed.

Arable soils of the Canton of Redon with respect to phosphoric acid, G. LECHARTIER (*Compt. Rend. Acad. Sci. Paris, 130 (1900), No. 19, pp. 1225–1229; abs. in Jour. Chem. Soc. [London], 78 (1900), No. 452, II, p. 433*).—About half of the soils of this canton contain more than 0.1 per cent of phosphoric acid. The average percentages of this substance in soils derived from different geological formations were as follows: From granite, 0.87; pre-Cambrian, 0.90; Armorican sandstone, 0.57; Angers schist, 1.04; Poligné schist and sandstone, 1.05; and alluvium, 1.24. Phosphatic fertilizers proved beneficial even in soils containing more than 0.1 per cent of phosphoric acid. The mineral phosphates and basic slag were more effective than superphosphate.

Composition of the soils of the Canton of Redon as regards lime, magnesia, potash, and nitrogen, G. LECHARTIER (*Compt. Rend. Acad. Sci. Paris, 130 (1900), No. 18, pp. 1163–1166; abs. in Jour. Chem. Soc. [London], 78 (1900), No. 452, II, p. 432*).—Analyses are reported of soils derived from granite, pre-Cambrian, Silurian, Upper Silurian, and ancient and modern alluvium formations. The average percentages of lime varied from 0.058 in Angers schist to 0.108 in Armorican sandstone soils; of magnesia, from 0.084 in granite to 0.16 in alluvial; and potash, from 0.232 in Angers schist to 0.577 in Poligné schist and sandstone. Nitrogen varied from 0.109 to 0.135 per cent.

Remarks on the sand-drift problem, J. H. MAIDEN (*Agr. Gaz. New South Wales, 11 (1900), No. 1, pp. 12–18*).—A brief report is given on the attempts which have been made to prevent the drifting of sands in two portions of New South Wales.

It was found at Newcastle that depositing ashes, cinders, and shale from collieries and tramways served to hold the sand to a marked extent. The addition of soil and manure rendered it possible to grow a number of plants.

A list of shrubs and trees suitable for seaside planting is given, together with brief notes as to their relative value. Among grasses, which are the most important of sand binders, notes are given on Bermuda grass, *Festuca littoralis*, carpet or Louisiana grass, marram grass (*Psamma arenaria*), *Saccharum arundinaceum* and *S. spontaneum*, *Spinifex hirsutus*, St. Augustine grass (*Stenotaphrum americanum*), and coast couch grass (*Zoysia pungens*).

Water and water supplies, J. C. THRESH (*Philadelphia: P. Blakiston's Son & Co., 1900, pp. VII + 438; rev. in Jour. Amer. Chem. Soc., 22 (1900), No. 4, p. 231*).—A second revised edition of this treatise.

Softening water for domestic use (*Tradesman, 43 (1900), No. 12, p. 97*).

The purification of water for household and technical purposes, O. KRÖHNKE (*Die Reinigung des Wassers für häusliche und gewerbliche Zwecke. Stuttgart: Ferdinand Enke, 1900, Vol. V, No. 3–5, ill.*).

Examination of water for sanitary and technical purposes, H. LEFFMANN (*Philadelphia: P. Blakiston's Son & Co., 1899, 4. ed. rev. and enl., pp. 145, ill.*).

Soil studies, A. M. SOULE (*Tennessee Sta. Rpt. 1899, pp. 37–39, fig. 1*).—A brief popular discussion of the physical properties of soils and their relations to moisture.

The study of sandy soils, WEISS-WITTSTOCK (*Deut. Landw. Presse, 29 (1900), No. 69, p. 857*).—A popular article pointing out the importance of farmers understanding the characteristics of their soils, especially in case of sandy soils.

Binding drift sand (*Jour. Agr. and Ind. South Australia, 3 (1900), No. 7, pp. 552–555*).—A list of plants for sand binding, with methods of planting.

Hamet Experimental Farm (*Semaine Agr., 20 (1900), No. 1005, pp. 261, 262*).—Mechanical and chemical analyses are reported of 5 samples of soils and subsoils from this farm, which is situated at Survilliers, Seine-et-Oise, France.

How are the best arable soils derived? HABERSTROHM (*Fühling's Landw. Ztg., 49 (1900), No. 17, pp. 638–642*).—A brief general discussion of the agencies involved in the formation of soils, the loess and chernozem soils being especially considered.

Practical utilization of soil analysis, H. LAGATU (*Prog. Agr. et Vit. (Éd. L'Est), 21 (1900), No. 35, pp. 278–284*).—A general discussion of this subject.

The influence of surface cultivation on the moisture of the soil, J. B. Reynolds (*Ontario Agr. Col. and Expt. Farm Rpt. 1899, pp. 24, 25, fig. 1*).—The experiments here described are a continuation of those of the previous year (E. S. R., 11, p. 625) and lead to the same conclusions.

Principles of plowing, A. M. Soule (*Tennessee Sta. Rpt. 1899, pp. 39-41*).—The interrelationship between plowing and the moisture content of the soil is brought out.

Soil temperature for the growing season, J. E. Bonebright (*Idaho Sta. Bul. 23, pp. 134, 135*).—A tabular record is given of weekly averages of soil temperatures at depths of 1 in. to 6 ft. during the growing seasons (April to October) of 1898 and 1899.

A contribution to the knowledge of nitrification, W. Migula (*Centbl. Bakt. u. Par., 2. Abt., 6 (1900), No. 11, pp. 365-370; abs. in Chem. Ztg., 24 (1900), No. 50, Repert., p. 183*).—Contrary to Ebermayer, the author found that the process of nitrification goes on in forest soils as well as in cultivated soils, varying somewhat with the depth and with the time of year.

Instructions for determining in the field the salt content of alkali waters and soils, M. Whitney (*U. S. Dept. Agr., Division of Soils Circ. 6, pp. 9*).—Instructions with formulas for the field standardization of the electrolytic bridge (E. S. R., 11, p. 325) in determining the salt content of soils and waters.

Available plant food, H. Snyder (*Proc. Soc. Prom. Agr. Sci., 1899, pp. 91-95*).—This is a discussion based mainly upon investigations by the author, which are reported elsewhere (E. S. R., 11, p. 1018), of the value of the Dyer and Goss methods for determining the available phosphoric acid in soils. The conclusion is reached that "both fail to indicate the amount of available phosphoric acid and potash. Both Dyer's method and Goss's method are without doubt applicable to certain types of soil, but they are not applicable to soils where a large part of the plant food exists in organic forms."

FERTILIZERS.

The storage of stable manure, F. Holdefleiss (*Mitt. Landw. Inst. Breslau, 1900, No. 3, pp. 49-55; abs. in Jour. Chem. Soc. [London], 78 (1900), No. 454, II, p. 571*).—In continuation of previous experiments (E. S. R., 11, p. 828), the author studied the gains or losses of different constituents in 3 lots of manure kept (1) without preservative, (2) with the addition of potassium salt, and (3) with superphosphate. The preservatives reduced the loss of proteid nitrogen and increased considerably the amount of nitrogen in the form of ammonia. Of the nonnitrogenous constituents the pentosans were most readily decomposed. In case of crude fiber free from pentosans there was a loss of 17.5 per cent in one instance and gains of between 7 and 8 per cent in other instances.

Economy in the use of barnyard manure, W. Saunders (*Proc. Soc. Prom. Agr. Sci., 1899, pp. 47-52*).—This is a discussion of this subject based upon the results of experiments during 11 years at the Central Experimental Farm at Ottawa, Canada (E. S. R., 11, p. 833). These experiments were designed mainly to test the relative merits of barnyard manure when applied to different crops fresh from the barnyard, as compared with the same material rotted. The data obtained in experiments with spring wheat, barley, oats, corn, mangel-wurzels,

turnips, carrots, and potatoes are tabulated and discussed. The conclusion drawn from this data is that if farmers would preserve "all the liquids with the solids in water-tight troughs behind the animals, using cut straw for bedding and as an absorbent; then distribute this over the land in a fresh condition before any of the liquids so rich in fertilizing constituents are decomposed, the saving effected would be enormous, and the value of barnyard manure in bringing increased crops would probably be nearly double what it now is."

The reduction of nitrates in the presence of barnyard manure, J. P. Street (*New Jersey Stas. Rpt. 1899, pp. 86–96*).—Previous investigations on the subject are briefly noted, and an account is given of a study of the changes in the nitrogen of a mixture of fresh solid cow manure (about 30 gm.) with nitrate of soda (1.25 gm.), with sulphate of ammonia (1 gm.), and with dried blood (1.5 gm.), with or without the addition of gypsum, acid phosphate, kainit, and sulphur (each 0.2 gm.), and carbon bisulphid (20 cc.). The volume was in each case made up to 300 cc. with water and the mixtures kept in open flasks in the laboratory at about 20° C. from February 28 to March 29, with occasional shaking. Two series of experiments were made—one being examined for nitrates by the Schulze-Tiemann method at intervals of 7, 14, and 24 days, the other remaining undisturbed until the end of the period. In case of the mixture of manure and nitrate denitrification was complete in 24 days; with other substances added to this mixture, the periods of denitrification were as follows: With gypsum 27 days, acid phosphate 27 days, kainit 16 days, and sulphur 23 days. The mixture sterilized with carbon bisulphid lost only 9.6 per cent of its nitrates in 24 days.

In case of sulphate of ammonia the changes in the nitrogen were slight, the greatest loss in 24 days being 4.1 per cent where acid phosphate was used. There was a slight gain in case of kainit and gypsum.

The examination of the second series of tests showed approximately the same results as the first as regards the nitrate.

"The loss where kainit was used was complete, as it was before, while the nitrate alone and nitrate with acid phosphate suffered a loss of over 97 per cent. The losses where sulphur and plaster was used were somewhat less, being 93.7 per cent and 85.4 per cent, respectively. The plaster seemed in this test to have a slight retarding effect on denitrification. The loss where carbon bisulphid was used, while more than in the first series, was only about one-fourth of that sustained by the other tests."

In the sulphate of ammonia tests, the changes in nitrates and total nitrogen were comparatively insignificant. There was a considerable gain in soluble organic nitrogen in every case, being most pronounced where carbon bisulphid and sulphur were used. This was also true of the nitrate series. There was also a marked gain in insoluble organic nitrogen in the sulphate of ammonia tests, being largest where the sulphate was used alone and least where carbon bisulphid was used.

Considerable amounts of free ammonia were formed during the fermentation, especially in the sulphate of ammonia tests in which kainit was used. In the dried blood tests all of the nitrates and combined ammonia were lost. Kainit appeared to have had a strong influence in liberating ammonia, causing a loss of over 26 per cent of the total nitrogen present. Carbon bisulphid on the other hand exerted a retarding influence in this respect.

Investigations relative to the use of nitrogenous materials, E. B. VOORHEES (*New Jersey Stas. Rpt. 1899, pp. 97-120*).—A review is given of literature relating to denitrification and the changes which may occur in the nitrogen of barnyard manure, and investigations relating to the composition, and the availability of the nitrogen of solid and liquid manure are reported.

The solid and the mixed solid and liquid excrement (without litter) of a well-fed cow were analyzed when fresh and after being exposed to fermentation and leaching in the open air in 100 lb. lots from February 4 to June 15. In that time the weight of the solid manure was reduced to 50 lbs., the mixed solid and liquid manure to 61 lbs. The composition of the fresh and leached manure, calculated to a water-free basis, was as follows:

Composition of manures on water-free basis.

	Fresh manure.		Leached manure.	
	Solid.	Solid and liquid.	Solid.	Solid and liquid.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Ash	12.166	12.924	14.161	15.282
Organic matter	87.834	87.076	85.839	84.718
Nitrogen (total)	2.286	3.553	2.489	2.529
Nitrogen soluble in water	.583	1.876	.377	.734
Nitrogen as nitrates	.101	.013	.058	.014
Nitrogen as ammonia	.248	1.070	.182	.521
Nitrogen soluble organic	.234	.793	.137	.199
Nitrogen insoluble organic	1.703	1.677	2.112	1.795
Phosphoric acid	2.915	2.582	1.408	1.617
Potash	1.488	2.331	.584	1.062

In the solid manure there was a loss by leaching of 46 per cent of nitrogen, 72 per cent of phosphoric acid, and 80 per cent of potash; in the mixed solid and liquid manure 57 per cent of nitrogen, 62 per cent of phosphoric acid, and 72 per cent of potash.

The availability of the nitrogen of fresh and leached solid and mixed solid and liquid cow manure used alone or in connection with nitrate of soda, sulphate of ammonia, and dried blood was tested in a series of experiments with corn and tomatoes grown in cylinders (without bottoms) 23½ in. in diameter, and 4 ft. long, sunk in the ground. The soils used were made as uniform as possible—a medium clay for the corn, a sandy loam for the tomatoes. The applications of manure were larger than are usual in practice, but not excessive, the largest application being about 20 tons per acre. The results of the corn experiments

are reported. These show that in every case there was a decided gain in weight of dry matter due to application of the nitrogenous fertilizers. There was also a considerable but more variable gain of nitrogen. The comparative availability of the nitrogen in the different forms of the manure as shown by these experiments was as follows:

Comparative availability of nitrogen in cow manure.

Character of manure.	Nitrogen recovered.	Increase in dry matter.	Increase in dry matter on basis of nitrogen in unleached manures.
	Per cent.	*Per cent.*	*Per cent.*
Fresh manures:			
Solid	7.44	15.4	
Solid and liquid	22.04	59.4	
Leached manures:			
Solid	16.80	33.0	23.2
Solid and liquid	22.36	36.1	36.1

"The yields, when the various forms of yard manure are applied, together with nitrates in different quantities as well as with ammonia and dried blood, show one thing very clearly, viz, that the total recovery of nitrogen is in every case greater where the different materials are used together than when they are used singly. . . .

"It is also shown that the losses are not very different when the manure is used with the small or the large amount of nitrate of soda, which would seem to argue that the nitrogen was not dissipated by denitrification, but that the losses were due to other causes."

The relative availability of the nitrogen in the artificial forms and in the various kinds of cow manure, based upon recovery of nitrogen in the crop, is shown in the following table:

Relative availability of nitrogen in different forms.

	Per cent.
Nitrate of soda	100
Sulphate of ammonia	99.5
Dried blood	95.4
Solid manure, fresh	16.76
Solid manure, leached	37.86
Solid and liquid manure, fresh	49.66
Solid and liquid manure, leached	50.38

A summary is given of the results of experiments with nitrogenous fertilizers in different parts of New Jersey, which have already been published in a bulletin of the station (E. S. R., 11, pp. 439, 440, 444).

Experiments on the fertilizing effect of the phosphoric acid of bone meal, O. Kellner and O. Böttcher (*Deut. Landw. Presse, 27 (1900), No. 52, pp. 665, 666; abs. in Chem. Ztg., 24 (1900), No. 82, Repert., p. 22*).—This is an account of experiments with summer rye grown in pots containing 6 kg. of a moderately compact loam soil with 1.91 per cent of humus and a very small amount of lime. Ten samples of partly degelatinized bone meal were compared in these experiments with superphosphate and Thomas slag with and without the addition of lime (carbonate). The results indicate that on soils which are not

abundantly supplied with calcium carbonate the phosphoric acid of bone meal has an important value especially for fall application. The bone meal, however, should not be applied on freshly limed soils or on those which are by nature rich in lime. The unfavorable results obtained by Wagner and Maercker with bone meal are attributed to the fact that these investigators experimented on soils which were rich in lime or had been recently limed.

Fertilizers (*New Jersey Stas. Rpt. 1899, pp. 17–85*).—This is mainly a reprint of Bulletin 139 (E. S. R., 11, p. 829), with the addition of statistics of the fertilizer trade in New Jersey during 1898 and thirteen preceding years, the market prices of fertilizers, text of the fertilizer law, and lists of inspectors and of manufacturers whose goods were inspected in 1899. From data furnished by 92 out of 109 firms selling fertilizers in New Jersey in 1898 it is estimated that the total consumption of fertilizers in the State was 60,094 tons, valued at $1,569,061, in 1898, as against 56,172 tons in 1897. "The complete manures represent 70 per cent of the total number of tons sold in 1898 and 77 per cent of the total values of all sales." It will thus be seen that the farmers of the State paid over $1,200,000 for complete manures during 1898. The statistics reported show that there has been a decline in the prices of complete fertilizers from 1885 to 1898, but that this decline in price has not been accompanied by a corresponding decrease in the absolute amounts of plant food delivered to consumers.

Some principles in the use of fertilizers, C. A. Mooers (*Tennessee Sta. Rpt. 1899, pp. 46–50, fig. 1*).—A general discussion.

Suggestions for the use of barnyard manure, C. Wellington (*Massachusetts State Bd. Agr. Rpt. 1899, pp. 301–315, pl. 1*).—A general discussion of this subject under the following heads: What barnyard manure is made of, how it compares with other manures, how to make it, and how to use it.

On the fertilizer valuation of sewage, W. Bresler (*Deut. Zuckerind., 25 (1900), No. 34, Sup. 1, pp. 1338, 1339*).—Brief descriptions are given of various methods which have been proposed for estimating the fertilizing value of the sewage from cities and factories of various kinds.

Fertilizer inspection, C. D. Woods (*Maine Sta. Bul. 60, pp. 23–30*).—"This bulletin contains the analyses of manufacturers' samples of brands of fertilizers licensed before March 7, 1900," accompanied by brief statement of the chief provisions of the State fertilizer law. The number of analyses reported is 131.

Analyses of commercial fertilizers sold in Maryland, H. B. McDonnell et al. (*Maryland Agr. Col. Quart., 1900, No. 9, pp. 55*).—This bulletin contains a schedule of trade values of fertilizing materials, tables of analyses and valuation of 404 samples of fertilizers examined from March to July, 1900, inclusive, and a list of fertilizers licensed for sale in the State during the year ending February 1, 1901.

The composition and economical use of commercial fertilizers, H. J. Wheeler (*Massachusetts State Bd. Agr. Rpt. 1899, pp. 131–169*).—A very thorough general discussion of this subject.

Cooperative experiments with fertilizers, C. A. Mooers (*Tennessee Sta. Rpt. 1899, pp. 53–56*).—A plan of cooperative experiments in different parts of the State under supervision of the station is described.

Perchlorate in nitrate of soda, F. W. Dafert (*Oesterr. Chem. Ztg., 3 (1900), No. 15, pp. 369, 370*).—Examinations of a number of old samples of nitrate of soda as well as various museum specimens of crude nitrate, etc., are reported, which show that in only two of the old samples of nitrate was perchlorate present, while none of the museum specimens contained this substance. From these facts the author concludes that perchlorate is an impurity which has appeared in nitrates only in recent years.

Chemical fertilizers, de Coquet (*Engrais chimique. Paris: J. B. Baillière & Sons, 1899*).

Decomposition of bone meal by micro-organisms, J. Stoklasa (*Centbl. Bakt. u. Par., 2. Abt., 6 (1900), No. 16, pp. 526–535, fig. 1; Böhm. Ztschr. Zuckerind., 24 (1900), p. 627; abs. in Chem. Ztg., 24 (1900), No. 68, Repert., p. 244*).—The results of a series of laboratory and plant-house experiments are reported, which show that the bacterial action in decomposing bone meal varies with the kind of organism and with the kind and amount of carbohydrates present. The practical application of the results is discussed.

FIELD CROPS.

Grain experiments: Surface and subsoil or underground moisture, A. E. Shuttleworth (*Ontario Agr. Col. and Expt. Farm Rpt. 1899, pp. 44–48, fig. 5*).—In these experiments, surface soil from a field in which roots had been grown the preceding year, was thoroughly mixed and used in 10 galvanized iron cylinders, 12 in. in diameter and 3 ft. long, and so constructed that water could be applied from the bottom in imitation of underground moisture. The cylinders were placed in 2 parallel rows. A cotton sheet containing circular holes was stretched over them in such a way that only the surface of the soil was exposed to the sun. Oats, barley, wheat, and peas were grown. One cylinder of each was subwatered, while the duplicate pots were surface watered. The surface-watered oats required 43 lbs. of water from the time they were sown until maturity; barley, 38.5 lbs.; wheat, 29.75 lbs.; and peas, 28 lbs. The water required for maturing the crops in the subwatered cylinders was as follows: Oats, 65.25 lbs.; barley, 25.5 lbs.; wheat, 34.25 lbs.; and peas, 104 lbs. The total yields, including grain, straw, and roots, obtained in the different pots are shown in the table below:

Yield of crops grown in surface and subwatered cylinders.

	Oats.	Barley.	Wheat.	Peas.
	Grams.	*Grams.*	*Grams.*	*Grams.*
Surface watered	67.66	45.39	29.95	63.32
Subwatered	82.39	45.34	26.62	116.60

The surface-watered oats ripened 4 days earlier than the subwatered, but the yield of both grain and straw was considerably less. In the case of barley there was little difference in growth, maturity, and yield between surface-watered and subwatered pots. The results in this case are interpreted as showing the necessity of surface moisture,

and hence the desirability of fall plowing for barley. The root development of wheat in the subwatered pot was somewhat better than in the surface-watered pot but it is thought that the yield would have been greater had the crop in the subwatered pot not been injured by blight. Peas developed especially well in the subwatered pot.

On variations in plants with special reference to the relation between the grain weight and the nitrogen content of barley, W. Johannsen (*Medd. Carlsberg Lab., 1899, No. 4, pp. 228-313*).—Experiments are reported with Carter Goldthorp barley which were made with the object of producing a strain especially low in nitrogen, but having a large and plump grain, to meet the requirements of a good malting barley. In the fall of 1893, 500 practically perfect heads of this variety were picked from 8 different places in a barley field, out of which the best 86 heads were chosen to form the foundation stock for the study. Five kernels on the same side of each head were taken for analysis and their weights and nitrogen contents determined in case of each head. The average weight per kernel ("grain weight") for all 86 samples was 62.28 mg., and the average nitrogen content 1.606 per cent. By grouping the results as to the grain weight, a marked increase in the nitrogen content was found with increasing grain weight.

In 1894 the kernels from a number of the best heads were sown separately and at harvest 185 of the largest and finest heads were analyzed as in the previous year. The average grain weight was 54.24 mg., and the average nitrogen content 1.489 per cent. Here again the nitrogen content increased, as a rule, with the weight of kernel, although there were exceptions to this general rule in about 30 per cent of the cases.

About 50 heads from the crop of 1894 served as seed in 1895, selected mostly from the exceptions mentioned above, and this was repeated the two following years. Through systematic selection of heads with heavy kernels and low nitrogen content for 3 generations, a progeny was obtained in the fourth generation, samples of which were characterized by a somewhat higher average grain weight and an appreciably lower nitrogen content than that found in the rest of the crop. The following summary shows the results obtained with 2 samples and their progeny:

Grain weight and nitrogen content of barley from selected seed.

Year.	Average for year.			Sample 13 and progeny.			Sample 182 and progeny.		
	Number of samples.	Grain weight.	Nitrogen content.	Number of samples.	Grain weight.	Nitrogen content.	Number of samples.	Grain weight.	Nitrogen content.
		Mg.	*Per cent.*		*Mg.*	*Per cent.*		*Mg.*	*Per cent.*
1894	173	54.3	1.490	....	54.8	1.310	....	56.6	1.430
1895	515	45.0	1.510	3	47.6	1.413	4	46.8	1.413
1896	347	56.0	1.680	1	59.4	1.630	6	59.4	1.650
1897	140	51.4	1.606	10	57.3	1.612	16	49.0	1.487

The average of 26 samples of 182 grown in 1897 was a grain weight of 52.2 mg. and a nitrogen content of 1.535 per cent, while the average of all other samples grown that year was 51.3 mg. and 1.622 per cent.

The results would seem to justify the conclusion that the correlation between grain weight and nitrogen content can be disturbed by systematic selection, and can not, therefore, be of paramount importance in the improvement of plants. Correlations were found between the length of head and the grain weight (the latter increasing with the former), and between length of head and nitrogen content (the latter likewise increasing with the former). But these correlations are still less fixed than that of the grain weight and the nitrogen content. The length of head and the number of kernels in the head, on the other hand, stand in a much closer relation than the preceding factors, although in the author's opinion a perfect correlation does not exist even here.

The theory of the incompatibility of valuable qualities in cultivated plants, especially emphasized by Schindler and von Proskowetz, according to the author, has but slight scientific importance, while, viewed from a practical standpoint, it is only an expression of the fact that certain ends aimed at in the improvement of crops are more difficult to reach than others. Practical experiences must be carefully scrutinized before they are used for the support of the principle of heredity and variability. In the point under discussion one must be particularly on the lookout for complications brought about by external conditions, the confounding of which with correlation phenomena may cause considerable confusion.—F. W. WOLL.

Some investigations of the relation of the size of grain to the nitrogen content of wheat and peas, W. JOHANNSEN and F. WEIS (*Tidsskr. Landbr. Planteavl, 5 (1899), pp. 91–100*).—The investigations were conducted with 5 different kinds of wheat, viz, Sonne Extra Squarehead, Bahlson Squarehead, Urtoba Peters, Urtoba Metz, and Light-colored East Prussian wheat. The results obtained show that the different kinds of wheat grown in Denmark agree with the two-rowed barley in the relation between grain weight and percentage of nitrogen: as a general rule the percentage of nitrogen is increased with increasing grain weight, but there are many exceptions to the rule, so that this can not be used as an absolute starting point in studies of plant improvement.

In a supplement to this paper, W. Johannsen shows that this statement also holds good in case of Victoria peas. Ten large peas had an average weight of 0.450 gram, and an average nitrogen content of 3.35 per cent, against a grain weight of 0.226 gram and a nitrogen content of 3.17 per cent for 10 small peas. The average of 20 determinations was: Grain weight, 0.338 gram; nitrogen content, 3.26 per cent.—F. W. WOLL.

Report of the experimentalist, C. A. ZAVITZ (*Ontario Agr. Col. and Expt. Farm Rpt. 1899, pp. 101-129*).—The experiments here reported consist largely of variety tests and are in continuation of the work reported in 1898 (E. S. R., 11, p. 628). The work recorded covers experiments with oats, winter and spring wheat, barley, rye, buckwheat, Indian corn, teosinte, grasses, millet, sachaline, prickly comfrey, spurry, yarrow, potatoes, field roots, chicory, rape, kale, cabbage, white mustard, field peas, cowpeas, grass peas, Egyptian peas, *Lathyrus sylvestris*, field beans, soy beans, horse beans, velvet beans, clover, alfalfa, sanfoin, vetch, lupines, lentils, serradella, peanuts, flax, hemp, ramie, chufas, pumpkins, squashes, and sunflowers.

The Joanette heads the list as regards yield of oats. It is a black variety, possessing a very short straw, suitable for growing only on lands which naturally produce a large amount of straw. It stools abundantly and should not be seeded at a rate greater than 4 pecks per acre. The crop should be cut while somewhat green to avoid shelling. White Siberian stands next on the list. It is the most extensively grown and popular oat in Ontario, and has made the highest average record of all the oats grown in cooperative tests for 7 years.

In the fall of 1898, 87 varieties of winter wheat were sown at the station. Many of the varieties winter-killed. The hardiest varieties were Tasmania Red, Red Velvet Chaff, Red Wonder, Prize Taker, Standard, Soules, Siberian, Dawson Golden Chaff, Pride of Genessee, and Early Arcadian, mentioned in the decreasing order of merit. Dawson Golden Chaff has given the largest yield of 70 varieties tested for 5 years, with Early Genessee Giant a close rival. These, with the American Bronze, possessed the stiffest straw of the large yielders. Winter wheat that does not lodge until cut has produced a crop more than double the value of the lodged grain. Large, plump grains have given better results for seeding than those which were small, shrunken, or broken. As catch crops preceding winter wheat, peas have given the best results and buckwheat the poorest. The largest yield of grain and the best quality of seed have been obtained by allowing the grain to ripen fully. Copper sulphate and hot water treatment have been found effective in combating stinking smut.

The trials of common varieties of spring wheat show greatest yields from Red Fife, Herison Bearded, Saxonka, and Wellman Fife. Spring wheat with a solid straw has been tested and some varieties have exceeded in yields the common kinds. By far the largest yield in the solid straw varieties was given by Wild Goose, a hard wheat yielding a yellow flour. During the last 3 years there has arisen a demand for this wheat for shipment to Italy for manufacturing macaroni, so that at present it commands a higher price than the finer varieties.

In tests of 200 varieties of corn grown at the station during the past 3 years Mammoth Cuban and Mastodon Dent have been found well

adapted to the warmer soils of southern Ontario. Wisconsin Earliest White Dent for southern and central Ontario, and Salzer North Dakota, Compton Early, and King Phillip for central and northern Ontario.

In experiments with grass mixtures for pasture or hay the best and most permanent mixture has consisted of 4 lbs. of orchard grass, 4 lbs. of meadow fescue, 3 lbs. of tall oat grass, 2 lbs. of timothy, 2 lbs. of meadow foxtail, 5 lbs. of alfalfa, 2 lbs. of alsike clover, 1 lb. of white clover, and 1 lb. of trefoil. The yield from this mixture has averaged 3.6 tons per acre. Fringed brome grass alone has averaged 3.9 tons of hay per acre during a period of 5 years. Teosinte, sachaline, prickly comfrey, spurry, *Lathyrus sylvestris*, cowpeas, velvet beans, tufted and kidney vetches, crimson clover, lupines, lentils, serradella, and ramie have thus far proven unprofitable crops for Ontario.

Extensive variety tests of potatoes for a number of years lead to the recommendation of Empire State, American Wonder, Pearl of Savoy, and Rural New Yorker No. 2 as the best varieties for general cropping in Ontario. Of the Swedish turnips grown Hartley Bronze Top and Buckbee Giant are recommended. The Wisconsin Blue pea has been found identical with the Striped Wisconsin Blue, and the Small Canadian Blue identical with the Prussian Blue.

Alfalfa seems adapted to certain sections of Ontario, but is not generally satisfactory. Hairy vetch has averaged 10.2 tons of green crop per acre, which is about 2½ times as much as the yields obtained with common spring vetch (*Vicia sativa*). Some of the earlier varieties of peanuts have been grown to perfection on the sandy loam soils in the warmest portions of the Province. Russian flax has given the best yields of seed per acre. Chufas have averaged 22.6 bu. per acre at the station. Black Giant and Mammoth Russian have proven the best yielding varieties of sunflowers. Rennie Yellow Mammoth Squash produced the heaviest yield of pumpkins and squashes tested, followed by Thorpe Mammoth Pumpkin and Mammoth Bright Red Etampes.

Turkestan alfalfa, P. B. KENNEDY (*U. S. Dept. Agr., Division of Agrostology Circ. 25, pp. 20*).—A report relative to the growth and value of Turkestan alfalfa (*Medicago sativa turkestanica*), imported and distributed by this Department in 1898 and 1899. Notes on the natural condition of the soil and climate of Russian Turkestan, the native home of the Turkestan alfalfa distributed, are given.

Out of 466 reports received relative to its value, 237 indicate some superiority over the common alfalfa. Many of the reports from experiment station workers and others in the different States as regards results secured are quoted:

"The reports from the region west of the Mississippi River and north of Kansas and California indicate that this variety is hardier and more productive than that commonly grown in this region. It seems to endure drought better, is not so easily

affected by freezing, and gives better results on strongly alkaline soils. In the East, however, where there is a heavy rainfall and where heavy soils predominate, this variety seems to be little, if any, superior to the French or Chilean varieties; in fact, it seems certain that, in some localities at least, it is less valuable. In the South so few tests have been made that no definite conclusions can be drawn, the reports from some sections being favorable to the Turkestan alfalfa, while those from others indicate that the commonly grown varieties are the most valuable. In the extreme Southwest the results are as yet quite contradictory, and further experimentation is needed.

"The seed of Turkestan alfalfa will germinate much quicker and the plants start into growth earlier under the same conditions than common alfalfa. The plants are more leafy, grow more rapidly, and have a stronger, more vigorous root system. Another advantage which the Turkestan variety has is that the stems are more slender and less woody, the plants making a more nutritious hay of finer quality. That it will withstand drought under the same conditions better than ordinary alfalfa seems certain from the reports of the experimenters. In the West and Northwest, at least, it seems to be more productive, both with and without irrigation."

Experiments with three varieties of corn, C. B. LANE (*New Jersey Stas. Rpt. 1899, pp. 201, 202*).—The relative value of Southern White, Leaming, and Early Klondike field corn and their adaptability to the soil and climate of the station were studied. The results as regards yield of stover and grain are shown in tabular form. "The Southern White variety gave highest yields of both corn and stover, although the proportion of cobs to shelled corn was 24 per cent, or 7 per cent higher than the Leaming and 8 per cent higher than the Klondike." The total yield of ears of this variety was 133 bu. per acre. Leaming variety yielded 115 bu. per acre and Klondike 91 bu. per acre.

Fertilizer experiments with corn on washed land, C. A. MOOERS (*Tennessee Sta. Rpt. 1899, pp. 51–53*).—Corn was grown in 1899 on land that had lost the greater part of its surface soil by an overflow of the Tennessee River in 1875. Nitrate of soda and muriate of potash at the rate of 160 lbs. each per acre, and double this amount of acid phosphate, were used alone and combined in two's and three's as fertilizers. Stable manure at the rate of 5,000 lbs. per acre was used in some instances, combined with either potash, acid phosphate, or both. The results are tabulated and the profit or loss on the different plats calculated. The largest yield per acre, 32.4 bu., and greatest net profit, \$3.55, were obtained from the plat fertilized with stable manure and acid phosphate.

The ratio of stover to corn on the different plats was especially investigated. On the plat without fertilizer, the ratio was in the proportion of 3:1. This unusually wide ratio was not due to large stocks but to sterility, due in a large measure to deficiencies of nitrogen and phosphoric acid in the soil, as was shown by analyses of the soil from productive and nonproductive ear-bearing plats. A smaller amount than usual of these same elements was also found in the nonear-bearing stalks when analyzed.

Fertilizer experiments with cotton, G. W. CARVER (*Alabama Tuskegee Sta. Bul. 3, pp. 16, figs. 3*). Experiments were made in growing cotton with commercial fertilizers on a soil so exhausted and worn out that cowpeas failed to make a fair growth upon it. Sixteen tenth-acre plats divided into 2 equal series were used in the experiments. The series were duplicates except that one received burnt lime at the rate of 2,000 lbs. per acre. All the plats were plowed deep and well prepared. Nitrate of soda was used at the rate of 200 lbs. per acre, acid phosphate at the rate of 600 lbs. per acre, and muriate of potash at the rate of 120 to 240 lbs. per acre. These fertilizers were used in combinations of two's and three's. In one instance sulphate of potash was used at the rate of 240 lbs. per acre for comparison.

Sweet potatoes were grown on the plats the first year, and cotton the second. Nitrogen was again added to the plats the second year, but none of the other fertilizers. The yield of seed cotton on the fertilized plats of the unlimed series averaged about 6 times that from the unfertilized plats of the same series; and the yield on the unfertilized limed plats was more than double that of the unfertilized plats of the unlimed series.

Lime used in connection with other fertilizers seemed to have no special effect on the yield. In these experiments the combination of 120 lbs. of muriate of potash and 200 lbs. of nitrate of soda gave the largest net money returns. All combinations, however, were used at a profit except possibly the plat which was fertilized with phosphoric acid and nitrogen. Sulphate of potash gave slightly better results than muriate. Phosphoric acid used with potash and nitrogen decreased the yields. Doubling the amount of potash in the formula increased the yields of seed cotton 102 lbs. per acre.

Notes on cowpea tubercles, C. B. LANE (*New Jersey Stas. Rpt. 1899, pp. 200, 201, pl. 1*). The third successive crop of cowpeas is reported upon. The first season but few tubercles were noted and the yield of forage was 6.56 tons per acre. The second year the tubercles were more abundant and the yield of forage per acre is reported at 7.19 tons. The third season the tubercles grew abundantly and the yield of forage per acre is given at 10.02 tons. The fertilizer applied the third season was less than one-half the amount applied the second, and it is believed that the increase is due in a large measure to a greater abundance of tubercles.

A special experiment with forage crops, C. B. LANE (*New Jersey Stas. Rpt. 1899, pp. 196–199*).—The value for forage of a number of plants not commonly grown at the station was tested. The crops were grown on one-twentieth acre plats and consisted of 3 varieties of corn, Yellow and Rural Branching doura, Early Orange and Early Amber sugar cane, Red and White Kafir corn, teosinte, Evergreen

broom corn, Dwarf Essex rape, cowpeas, soy beans, and velvet beans. The yield obtained on each plat, nutrients per acre, and character and value of each crop are noted.

The Evergreen broom corn produced the highest yield of total nutrients per acre. Its high percentage of fiber and the fact that it is not readily eaten by stock make it an undesirable forage crop. Corn, on account of its succulence, palatability, and total food value is placed at the head of the list. The douras are not as desirable a forage crop as corn because they are not so palatable. Velvet beans, while rich in protein and readily eaten by stock, are too expensive as regards seed to occupy a place in a forage crop rotation at the station. The low yield obtained with soy beans prevents their recommendation as a general forage crop. Dwarf Essex rape, while rich in protein, can not be recommended for the dairy because of the flavor it imparts to the milk. It is considered admirably suited for sheep and hogs.

"The sugar canes, Kafir corns, and teosinte do not possess any marked advantages over Indian corn, and are found to be much inferior in yields of nutrients per acre. The cowpea stands lower in total nutrients than many of the other crops, but it is valuable because of its palatability and the high percentage of protein it contains."

Cooperative experiments with grasses and forage plants, P. B. KENNEDY (*U. S. Dept. Agr., Division of Agrostology Bul. 22, pp. 86, pls. 13, fig. 1*).—A tabular register is given of the different grass and forage plant seeds distributed throughout the United States and foreign countries for the fiscal years 1897–1899, inclusive. Of 251 varieties of seeds sent out, reports of investigators are presented covering 40 of these. These reports are from many States and discuss soil, planting, harvesting, ripening, yield, quality, and value of the plants for the different localities.

The varieties of plants most extensively distributed were Turkestan alfalfa, blue grama, burr clover, Dwarf Essex rape, hairy vetch, Japanese barnyard millet, meadow fescue, Metcalfe bean, Russian clover, rescue grass, Rhode Island bent grass, shad scale, smooth brome grass, slender velvet grass, side oats grama, soy beans, sorghum, sulla, velvet bean, and Virginia lime grass.

Kafir corn, H. M. COTTRELL, D. H. OTIS, and J. G. HANEY (*Kansas Sta. Bul. 93, pp. 29–48, figs. 4, maps 2*).—A popular bulletin summarizing the results of cultural and feeding experiments with this crop at the station. The feeding experiment is noticed elsewhere (p. 375).

Two varieties of Kafir corn are grown in Kansas, the red and black-hulled white. The latter has proven the more profitable at the station. In three-year comparative trials Kafir corn was found to be superior to rice corn, Jerusalem corn, and millo maize. The averages of 11 years show a production of Kafir corn of 46 bu. per acre, and of corn 34.5 bu. per acre.

The results of observations are given on seeding, cultivating, harvesting, and threshing Kafir corn, and the danger to stock when grazing on second growth, and other objections to Kafir corn are discussed. Statistical maps of the State are shown, and from the facts presented advice is given on growing Kafir corn in different parts of the State.

Fertilizer experiment with potatoes, H. J. WHEELER and J. A. TILLINGHAST (*Rhode Island Sta. Bul. 65, pp. 127-134*). The object of the experiment was to compare the effect upon the yield of potatoes of similar amounts of nitrogen applied alone and in combination in the form of nitrate of soda, sulphate of ammonia, and dried blood; also to test the influence of potash applied as sulphate and as muriate and a combination of equal amounts of the two. The fertilizers were applied in the drill at the rate of 1,500 lbs. per acre, containing nitrogen, 4.7 per cent; potash, 9.3 per cent; and phosphoric acid, 9.3 per cent.

As the sole source of nitrogen for potatoes, dried blood ranked first, followed by nitrate of soda and sulphate of ammonia. The best combination for nitrogen appears to be either two-thirds dried blood and one-third nitrate of soda, or else equal parts of the three fertilizers mentioned. Experiments at this station have shown that on extremely acid soils dried blood is only about one-half as assimilable as it should be. Such soils should be limed in order to get the full benefit of this fertilizer.

As a source of potash, the high grade sulphate proved somewhat superior to the muriate. There was a net gain from using the sulphate even after deducting the higher cost. However, better results at less expense were obtained by applying the potash in equal amounts of sulphate and muriate.

Soil inoculation for soy beans, H. M. COTTRELL, D. H. OTIS, and J. G. HANEY (*Kansas Sta. Bul. 96, pp. 97-116, pls. 6, dgms. 2*). The preliminary experiments reported herewith on root tubercles and their production by inoculation have been abstracted from another source (E. S. R., 10, p. 119). This earlier work showed that inoculating soil for soy beans was entirely practicable. Experiments were therefore undertaken to extend the work under field conditions. Beans were (1) inoculated with a water extract of infected soil; (2) with the mud which remained after the extract had been decanted; (3) were drilled in with 150 to 750 lbs. of inoculating soil per acre; and (4) planted and inoculated soil sown broadcast over the field, both before and after seeding, at rates of 100 to 1,000 lbs. per acre. "The only satisfactory results were obtained by drilling the infected soil with the seed." No tubercles developed when the infected soil was sown broadcast. "In a plat inoculated with Massachusetts soil 2 years before, 20 plants bore 136 tubercles. . . . In another plat inoculated Massachusetts soil was spread thickly in the bottom of the drilled fur-

row and the seed dropped in it. Twenty plants in this plat bore 509 tubercles on their roots."

In another experiment soy beans were planted on a field of 11½ acres which had been inoculated with infected soil at the rate of 1,000 lbs. per acre sown broadcast and harrowed in. "A careful examination of hundreds of plants in this field failed to show a single tubercle, and this method with the quantity of soil used is a total failure." In a later experiment 46 acres were inoculated with infected soil applied in the row by the use of a fertilizer attachment on the drill. "The results were satisfactory, nearly all plants bearing a large number of tubercles."

The value of tubercles on the roots of soy beans lies largely in the increased amount of nitrogen obtained from the air which they leave in the soil for succeeding crops. Even when the soil is not inoculated and no tubercles develop on the roots, the crop is still considered a desirable one to grow in rotation, both for those who own the land and for renters, because of its strong root system, drought-resisting qualities, and the large amount of protein furnished by the crop.

Directions for growing tuberculous-rooted soy beans on a small scale for the purpose of obtaining a supply of inoculated soil are given.

Sugar-beet experiments during 1899, A. J. McClatchie (*Arizona Sta. Bul. 31, pp. 263–272, fig. 1*).—These experiments on the station farm near Phoenix were made mainly to study the question of irrigation for the sugar beet. Incidentally data were secured on the limits of the season, best time to sow and harvest, and on the changes taking place in the beet during the time of ripening.

It was found advisable to irrigate the land before seeding and again when the plants were two or three months old. Excessive irrigation should be guarded against. While too much water increased the yield, it greatly reduced the percentage and total yield of sugar.

Beet seed germinated fairly well in the locality from September to May. A good stand may be secured without irrigation from December to March. The best results from winter-sown beets were obtained from a sowing made the latter part of January. Fair results were obtained in heavy soils from seeding as late as the first of April. Winter-sown beets improve in quality until the end of July, when they usually begin to deteriorate. Beets grown after beets resulted in a decreased yield.

Sugar beets, 1899, J. T. Willard and R. W. Clothier (*Kansas Sta. Bul. 94, pp. 49–55*).—Sugar beets were grown by 40 growers throughout the State and samples sent to the station for analysis. The data for the analyses are given in the usual tabular form. The average results obtained were not as good even as those obtained in previous years (E. S. R., 10, p. 346), the percentage of sugar in the juice averaging 10.89 and the purity coefficient 73.4. The author states

that "the results of the past 3 years confirm those of former years and indicate that while Kansas has produced many individual plats of excellent quality, she has produced more of inferior quality, and that States in higher latitudes are better situated for successful sugar-beet production."

Plans for growing sugar beets in 1900 in given localities are added, together with directions for growing sugar beets.

Sugar-beet investigations for 1899, J. L. Stone and L. A. Clinton (*New York Cornell Sta. Bul. 182, pp. 368-385*). A report is given on culture, variety, and fertilizer experiments with sugar beets at the station, and of cooperative experiments along the same lines carried out by 38 farmers living in the vicinity of the two sugar-beet factories of the State. Data as to the character of the soil, varieties of beets grown, yield per acre in tons, percentage of sugar in beets, and purity of the juice are tabulated.

In the cooperative tests the variety Zehringen contained the highest average percentage of sugar in the juice, 16.47, and the highest percentage of purity, 81.8, of the 5 varieties tested, but gave the lowest average yield of beets, 11.1 tons per acre. The variety Mangold yielded the most sugar per acre, 3,662 lbs.

In the culture experiments at the station the time of thinning the beets seemed to have no effect whatever on the percentage of sugar in the juice of the beets or on the purity of the same.

The effects of fertilizing sugar beets with different forms of commercial fertilizers alone and combined on plats made exactly similar as regards soil conditions, are shown in tabular form for the years 1897-1899, inclusive, and summarized for all 3 years.

"Where nitrate of soda was used alone as a fertilizer the percentage of sugar in the beets was very materially reduced, as was also the purity of the juice. The average percentage of sugar in the beets where nitrate of soda alone was used was 13.53, with the purity of the juice 81.6. The average of all plats where no nitrate of soda was used was 16.24 per cent of sugar in the beets, with a purity of juice of 86.63.

"Contrary to the popular belief, the beets upon the plat receiving muriate of potash alone as a fertilizer contained the highest percentage of sugar of any of the beets grown, and the purity of the juice compared well with that of all others. The percentage of sugar in the beets fertilized with muriate of potash alone was 17.02, with a purity of the juice of 85.94. The average percentage of sugar in the beets grown on all plats not receiving any muriate of potash was 15.82, with a purity of the juice of 86.04. It is usually considered that the sulphate of potash is superior to the muriate of potash as a fertilizer for sugar beets, but our experiments do not indicate that the sulphate is superior in any way to the muriate."

Bulk fermentation of Connecticut tobacco, M. L. Floyd (*U. S. Dept. Agr., Division of Soils Circ. 5, pp. 10*). Changes in "styles" in tobacco have made desirable changes in the character of the Connecticut Valley product to accord more nearly with the present market demands. The present circular gives the results of experiments car-

ried out in cooperation with the Connecticut State Station in fermenting Connecticut tobacco by the bulk method used in Florida (E. S. R., 11, p. 729), Sumatra, and Cuba. This method is considered superior to the case method (E. S. R., 11, p. 730) of fermentation usually followed in Connecticut, as it greatly shortens the period of fermentation, tends to give a better color and aroma, and to largely eliminate the element of chance in tobacco fermentation. Details as regards the method of handling and the temperature records obtained in the bulk fermentation of about 3,000 lbs. of all grades of good leaf and 1,900 lbs. of trash tobacco are reported.

With regard to the results obtained the author states that—

"The Connecticut tobacco is not supposed to have any desirable filler leaves for domestic cigars, but this year's experience has shown that the short top leaves if properly fermented will make a fairly good filler and that it will even pay to pick out such heavy-bodied top leaves from what is commonly classed as trash and ferment them for filler goods. Some of these heavy-bodied leaves were thoroughly fermented with very good results."

The expert opinions of a number of Connecticut and New York dealers as to the quality of the bulk-fermented tobacco were obtained.

"They pronounced the leaf perfectly sound in every respect, color very desirable, and even the whole leaf perfectly fermented and having the appearance of old tobacco, while the grain was perfectly developed and the style excellent. The burn was also good. . . . It was the general expression that more had been gotten out of the leaf than had ever before been obtained, and that the method would entirely supersede the present case method of fermentation."

Some of the top leaves of the trash which had been heavily fermented were made into "booked fillers" and submitted to dealers and manufacturers. They estimated its value at prices ranging from 15 to 18 cts. per pound, and in one instance, from 30 to 40 cts. per pound. Thin, trashy leaves were valued at about 7 cts. per pound.

In conclusion the author states that the work "while thoroughly satisfactory so far as the present style of leaf is concerned, has demonstrated that the Connecticut leaf needs to be radically changed to accord with the present market requirements." Experiments with this end in view are being inaugurated.

Experiments with Alinit on winter wheat, R. SALZER (*Deut. Landw. Presse, 27 (1900), No. 13, pp. 133, 134*).—This article gives the results of experiments with Alinit on winter wheat in different districts of Austria.

In a trial in Giuliomajor alluvial soil containing humus was used. The wheat was sown October 10, 1897, and the plats harvested July 15, 1898. The yield of the inoculated plat was 2,009 kg. per hectare; the uninoculated, 1,738 kg., a gain of 271 kg. per hectare with Alinit.

In Budovalla, on lowland not easily cultivated and that had been treated with stable manure after lying fallow, the inoculated plat pro-

duced 1,680 kg., the uninoculated 1,549 kg. per hectare; a gain of 131 kg. by the use of Alinit. In Csanad, on alluvial soil containing humus, the yield with Alinit was 1,542 kg. per hectare; without, 1,490 kg.; a gain of 52 kg. by inoculation. In the district of Vizesda, on sandy soil well treated with stable manure, the yield per hectare with Alinit was 2,207 kg.; without, 1,738 kg., giving a gain of 469 kg. by inoculation. Trials on sandy loam gave a yield with Alinit of 1,477 kg. per hectare; without, 1,450 kg.; a gain of 27 kg. by inoculation.

In all cases a gain in yield was obtained by the use of Alinit, and in every instance but two, in Csanad and again in Vizesda, the gains were made at a profit. The grain lodged but little on the inoculated plats, and was little affected by rust. These features are considered of considerable importance by the author and will be studied further.

Experience notes on plat experiments, B. D. HALSTED (*Proc. Soc. Prom. Agr. Sci. 1899, pp. 19–27*).—Difficulties to be met in securing accurate results in field experiments are noted and some suggestions given for overcoming them.

Cassava culture in Florida (*Tradesman, 44 (1900), No. 2, p. 67*).—A brief note calling attention to the importance of this industry in Florida.

Cassareep in Paraguay, J. N. RUFFIN (*U. S. Consular Rpts., 63 (1900), No. 236, pp. 12, 13*).—The growing of cassava in Paraguay is discussed, and the composition of two samples called *Mandioca dulce* and *M. amarga* is reported.

The manuring of catch crops, J. LESLIE (*Agr. Gaz. [London], 52 (1900), No. 1385, p. 36*).—Experiments in which the profitable use of commercial fertilizers, especially superphosphate and kainit, for catch crops of trifolium and Italian rye grass, are reported.

The utility of the cowpea, A. M. SOULE (*Tennessee Sta. Rpt. 1899, pp. 67–71, fig. 1*).—The value of the cowpea as a green manure and forage crop is discussed and suggestions given regarding its culture and use as a green manure. A comparison of its food value with that of other forage crops is made.

Notes on grasses, J. R. FAIN (*Tennessee Sta. Rpt. 1899, pp. 74, 75*).—Suggestions regarding seeding for succession. Timothy is regarded as excellent for permanent pastures in Tennessee.

Observations on buffalo grass, C. E. BESSEY (*Proc. Soc. Prom. Agr. Sci. 1899, pp. 105, 106*).—Notes on the disappearance of this grass from the western plains, with a brief account of a cultural experiment.

Why grasses fail, A. M. SOULE (*Tennessee Sta. Rpt. 1899, pp. 71–73, fig. 1*).—Lack of a properly prepared seed bed and the use of insufficient or impure seed are given as reasons for the failure of many meadows. Suggestions regarding seeding are given, together with a list of forage plants best suited to different soils and the amount of seed to be employed in each case.

The hop: Its culture and curing, marketing and manufacture, H. MYRICK (*New York: Orange Judd Co., 1899, pp. 299, figs. 137*).—"A practical handbook on the most approved methods in growing, harvesting, curing, and selling hops, and on the use and manufacture of hops." Chapters are given on the history and peculiarities of the industry; characteristics and composition of the hop plant and its fruit; climate and soils for hops; laying out hop yards; manuring, planting, tying, and cultivation; hop pests; harvesting the crop; kilns for curing hops; curing, baling, growing, sampling, and marketing hops; concentration in hop growing; expenses and profits in the industry, and hop statistics.

The work deals especially with the methods of hop growing in New York and the Pacific States. Methods and practices followed in England and Germany are also

considered in some detail. Not the least valuable feature of the work is a glossary of hop terms by N. F. Walter. A bibliography of 17 books on hops is appended.

Hop culture in California, D. FLINT (*U. S. Dept. Agr., Farmers' Bul. 115, pp. 26, figs. 2*).—This bulletin discusses the methods of hop culture followed in California, including systems of training, tying up the vines, harvesting, curing, baling, marketing, and the prices, wages, and expenses involved in hop growing in that State. Some introductory remarks on the botanical features of the hop plant, varieties of hops grown in this country, counties in California devoted to hop culture, and the climatic conditions of California are given. Some hop statistics prepared by the Division of Statistics of this Department as to the acreage, yield, and value of hops in the United States in 1889 and 1890 conclude the bulletin.

Our mustards and their rôle in agriculture, A. BAROT (*Nos moutardes et leur rôle en agriculture. Paris: Charles Mendel, pp. 63*).

Tests of Alinit in the culture of oats and barley, A. DAMSEAUX (*Bul. Agr. [Brussels], 15 (1899), No. 7, pp. 615, 616*).—Oats were not benefited by the use of Alinit. Barley gave increased yields of both grain and straw seemingly due to its action.

Oil-producing plants and their culture, V. KRIES (*Deut. Landw. Presse, 27 (1900), No. 63, pp. 784, 785*).—The various sorts of rape are dealt with especially.

Potato raising in Canada, W. T. MACOUN (*Amer. Gard., 21 (1900), No. 298, pp. 597–599*).—The author states that the average yield of potatoes in Ontario is 115 bu. per acre. The average yield of 15 varieties at the Central Experimental Farm in 1898 was 240 bu. per acre. This difference in yield is thought to be largely due to more careful selection of seed and varieties by the station than is usually given by farmers. Of white-skinned varieties American Wonder, Empire State, and Carmen No. 1 are recommended, and of pink potatoes Everett and Rochester Rose. Early Ohio is considered a good potato for the early market. Seed, cultural methods, spraying, world's production of potatoes, etc., are other subjects discussed in the article.

Experiments on pasture (*Farm and Home, 19 (1900), No. 963, p. 229*).—Some details as to the effect of various manurial dressings are reported.

Experiments on pasture, 1900 (*Agr. Students' Gaz., n. ser., 10 (1900), No. 1, pp. 16–19*).—Data on the hay yield of a large number of plats differently fertilized with commercial fertilizers and barnyard manure.

Manurial experiments in Devon (*Farm and Home, 19 (1900), No. 963, p. 228*).—A summarized report of results obtained by the Devon County Technical Education Committee in manurial experiments with root crops, potatoes, and grass.

Breeding experiments with rye and wheat, M. FISCHER (*Fühling's Landw. Ztg., 49 (1900), Nos. 16, pp. 609–613; 17, pp. 642–649, figs. 4*).—The interrelation of quality and color of the grain was studied.

Three years' fertilizer experiments with rye on light soil (*Deut. Landw. Presse, 27 (1900), No. 69, p. 861*).—Plat experiments were made and 19 combinations of fertilizers used. The results are tabulated. The greatest profit followed the use of a mixture of 448 lbs. of kainit, 336 lbs. of Thomas slag, and 112 lbs. of nitrate of soda.

When do swedes cease growing? (*Farmers' Gaz., 59 (1900), No. 26, p. 509*).—A record of measurements which show that in this test no root growth took place after November 1, though there was some leaf development.

Sugar beet analyses, A. E. SHUTTLEWORTH (*Ontario Agr. Col. and Expt. Farm Rpt. 1899, pp. 48–50*).—Analyses are given of a number of samples of sugar beets pulled at different dates between October 24 and November 27. The sugar in the beets ranged from 11.9 to 15.3 per cent with a purity coefficient varying from 74.1 to 82.5. The November-pulled beets were richest in sugar.

Improvement of sugar cane by chemical selection (*Florida Agr., 27 (1900),*

No. 33, pp. 495, 496).—Text of a paper read by Professor Albuquerque before the West Indian Sugar Conference, held at Barbados, on the practicability of increasing the sugar content of cane by planting seed selected from canes which are shown by chemical analysis to be especially rich in sugar.

Sugar cane culture in Ecuador (*Mitt. Deut. Landw. Gesell., 15 (1900), Sup. to No. 26, pp. 209-215*).—Cultural methods, methods and cost of manufacture, exports, and the possibilities of the sugar industry in Ecuador are considered in detail.

Tobacco (*Sci. Amer. Sup., 49 (1900), No. 1268, pp. 20332, 20333*).—Some general notes on the culture and manufacture of tobacco in this and foreign countries.

Tobacco (*Bul. Bot. Dept. Trinidad (1900), No. 24, pp. 252, 253*).—Tobacco in Trinidad gives the best results when seeded in September, planted out in November, harvested in February, and dried and cured by the methods followed in Cuba a month later. A crop in 1899–1900 yielded at the rate of 800 lbs. of tobacco per acre, estimated to be worth 12 cts. per pound. The largest item of expense was in picking the worms night and morning.

Field fertilizer experiments on tobacco, W. FREAR (*Pennsylvania Sta. Bul. 49, pp. 1-8*).—The data here recorded have been abstracted from another source (E. S. R., 11, p. 924).

Comparative analyses of tobacco, J. C. BRÜNNICH (*Queensland Agr. Jour., 7 (1900), No. 2, pp. 162, 163*).—Complete analyses as regards acids, gums, alkaloids, oil, starch, resins, albuminoids, pectose bodies, and ash constituents are given in parallel columns of Virginia and Queensland raw leaf tobacco.

Results obtained from the cross-fertilizing of cereals, W. SAUNDERS (*Proc. Soc. Prom. Agr. Sci. 1899, pp. 74–81*). Changes in the composition of wheat effected by climate, soil, etc., are mentioned. Some Russian, Indian, and other varieties of wheat used in crossing are noted, and descriptions given of 5 crossbred wheats originated by the author and 2 hybrid barleys.

Report on experiments carried out at the experimental plats at Drakesbrook, G. BERTHOUD (*Jour. Dept. Agr. West. Australia, 1900, May, pp. 56–76*).—Notes on the manuring and growth of a number of varieties of wheat on new lands, old lowlands, and on highlands; and on fertilizer and variety tests with potatoes.

Wheat manuring experiments in Victoria, A. N. PEARSON (*Jour. Agr. and Ind. South Australia, 3 (1900), No. 8, pp. 653–655*).—The average results are given of growing wheat with concentrated superphosphates alone and combined with nitrate of soda. In one experiment Thomas slag was used, and in another, sulphate of ammonia. The experiments were carried out in 5 different localities under very unfavorable weather conditions. The increased yields obtained due to the fertilizers varied from 1 to 5.33 bu. per acre. The use of 10 lbs. of concentrated superphosphate per acre was scarce sufficient, while the use of 30 lbs. generally proved superabundant. The medium dressing of 20 lbs. gave the best average results. The use of nitrogen seemed to decrease the effect of the superphosphate.

Thick and thin seedings, L. GRANDEAU (*Jour. Agr. Prat., 1900, II, No. 33, pp. 221, 222*).—Experiments carried out at Princes Park in seeding wheat and oats at different rates are reported. Wheat was drilled at rates of 90, 156, and 194 kg. per hectare, and oats at rates of 36, 105, and 162 kg. per hectare. With both crops the yields increased as the quantity of seed sown increased. In a test of sowing similar amounts of seed broadcast and in drills, seeding in drills gave largely increased yields over the broadcasted plats with both oats and wheat.

Deep-rooted plants as related to the health of crops, J. KLÖCKER (*Deut. Landw. Presse, 27 (1900), No. 49, pp. 631, 632*).—A compiled article showing the greatly increased length and development of potato roots when preceded by a crop of long-rooted lupines, and the consequent increase in growth of vines, freedom of the vines from disease, and yield of tubers. These results were especially noticeable in dry years, and are thought to be due to the greater supply of water brought within

reach of the plants by the longer roots, which resulted in a vigorous growth. Deep working of the soil produced similar results.

Accessories in grain breeding, VON SEELHORST (*Deut. Landw. Presse, 27 (1900), No. 43, pp. 533, 534, figs. 3*).—Devices to facilitate work in grain breeding and improvement are described, illustrations being given in some instances.

The value of seed selection, C. R. GIES (*Farming World, 18 (1900), No. 3, p. 117*).—The increased yields obtained by the author by using large plump seed rather than small plump seed are tabulated for oats, barley, wheat, and peas. With average crops on a farm of 100 acres the increased value of the crop due to seed selection is calculated at $217 yearly.

HORTICULTURE.

Experiments to determine the amount of water used by crops, H. VON SCHRENCK and H. C. IRISH (*Proc. Soc. Prom. Agr. Sci. 1899, pp. 96, 97*).—Pot and bench experiments in a greenhouse were made with radishes, cauliflowers, tomatoes, and beans. The maximum amount of water was required by the radishes during the third week's growth. With cauliflowers the maximum was reached after 10 weeks, and with beans and tomatoes after about 6 weeks.

In one experiment the fruit or heads of tomatoes, beans, and cauliflowers were removed as soon as formed in one series, while in the other they were allowed to mature. "The plants in the first series, on an average, had the period of maximum amount of water transpired at a later date than those of the second series." The amount of water transpired for each gram of dry substance formed by these vegetables was as follows: Radishes, 539 gm.; beans, 384 gm.; and cauliflowers, 324 gm.

Notes on vegetables, J. CRAIG (*Iowa Sta. Bul. 47, pp. 308–337, figs. 18*).—These notes are made up largely of results of variety tests with cucumbers, eggplants, peppers, Lima beans, sweet potatoes, and tomatoes. Cultural directions are given in each instance, together with the methods employed in combating injurious insects and diseases. Four recipes are given for preparing eggplant for the table.

The most satisfactory varieties of the different crops grown are as follows:

Cucumbers: *Early*—Boston Pickling, Evergreen, Green Cluster; *mid-season*—Cool and Crisp, Tailly Hybrid, White Spine, and Commercial Pickle; *late*—Long Green, Short Green, and Giant Pera. Eggplants: Fordhook Improved, New York Improved, White Improved, and Round Purple. Peppers: Red Chili, Ruby King, Golden Dawn, and Long Cayenne. Lima beans: Carolina, Jersey Extra Early, Horticultural Lima. Descriptive notes on 18 varieties are added. Sweet potatoes: Florida, Red Jersey, Benson, and Early Carolina. Descriptive notes on 12 varieties are added. Tomatoes: *Early mid-season varieties*—Early Ruby, Perfection, and Ignotum; *late varieties*—Buckeye State, Best of All, Favorite, and Fordhook First.

In a test of methods of training tomato vines 2 vines each of 6 varieties were (1) allowed to grow naturally, (2) trained to a 4 foot stake,

(3) hilled and a good-sized mound of earth drawn up at the base of the plants when fruit began to set, and (4) mulched, 4 in. of strawy manure being spread under the vines as the fruit began to set. The yields of good and of rotten fruits obtained from the different varieties by each method of training are detailed. The following table summarizes these data:

Results of training tomatoes.

Vines, how treated.	Yield, sound fruit.	Yield, rotten fruit.	Ratio, rotten fruit.
	Lbs. ozs.	*Lbs. ozs.*	*Per cent.*
Untrained	157 14	34 7	20.0
Staked	197 5	15 7	7.9
Hilled	184 10	20 10	10.8
Mulched	253 14	44 4	17.5

"This summary shows that the smallest yield was given by the untrained vines and that the percentage of rotten fruit on these was greater than in any other case; that staked vines gave a larger percentage of sound fruit than untrained and showed the smallest percentage of decayed fruit in the experiment; hilling did not give any striking results; mulching greatly increased the productiveness and also the tendency to rot. These are the results obtained during a year of unusually large precipitation in June and marked by light rainfall in August and September."

The solidity of the flesh of 13 varieties was determined by their specific gravity.

"According to this test Terra Cotta takes first place of those tested, being equal in weight to an equal volume of water. This indicates small seed cavities and firm flesh. There is a difference of 26 gm. between Terra Cotta and New Jersey, meaning that New Jersey was 26 gm. lighter than the volume of water which it displaced and thereby suggesting large seed cavities. Large seed cavities, or lack of solidity, would seem to be correlated with susceptibility to rot, as New Jersey, a light tomato, rotted to the extent of 27 per cent, while Terra Cotta and Lorillard, both heavy varieties, were affected to the extent of only 5 and 14 per cent, respectively."

Experiments with muskmelons, F. W. Rane (*New Hampshire Sta. Bul. 70, pp. 17–44, figs. 7*).—In the author's study of muskmelons an examination was made of the pistillate flowers of 93 varieties grown under both field and forcing-house conditions. In 83 of these so-called pistillate flowers he found both stamens and pollen, and the pollen was effective in the production of fruit. From these results it would seem that the general belief that the muskmelon is monœcious needs qualification.

An experiment was conducted to determine the comparative yield and profitableness of sowing seeds out of doors and of transplanting plants started early. Three varieties were used in the test. The vines grown in the field from seed gave the best yields in every instance. The comparative earliness up to September 5 of the trans-

planted vines and of the vines grown from seed sown in the field is shown in the following table:

Comparative earliness of muskmelons transplanted or sown in the field.

Variety.	Yield of 10 hills.				Total yield to Sept. 5.	Gain from transplanting.
	Aug. 23.	Sept. 1.	Sept. 2.	Sept. 5.		
Rose Gem:						
Transplanted	2	5	11	12	30	18
Seed			3	9	12	....
Netted Gem:						
Transplanted			10	13	23	17
Seed			2	4	6	....
True Jenny Lind:						
Transplanted		2	6	2	10	1
Seed			3	6	9	....

"Whether this extra-early yield [from transplanting] will pay for the extra labor can be determined only by the conditions and facilities of the grower. Generally speaking, it is doubtless a questionable undertaking, but in a few instances might be profitable." From September 5 on, the planted hills outyielded those which were transplanted.

In the experiment to determine the relative productiveness of pinched *v.* unpinched vines, pinching the main vines and allowing the laterals to grow naturally, or pinching the main vine when it was 3 ft. long and the laterals after two fruits had set on each, was found to increase the yield scarcely at all, and if the work of pinching be taken into consideration, the practice resulted in a loss. The practice of pinching or heading-in is not considered desirable when vines are grown out of doors.

Removing the staminate blossoms, which usually appear some time before the pistillate flowers, increased the yield slightly, but the additional labor required rendered the practice unprofitable.

Variety tests of muskmelons at the station have been previously noted (E. S. R., 10, p. 50). Illustrations and descriptions of varieties not previously noted are here included, together with tabular data on the yields, dates of ripening and flowering, and form characteristics of 95 varieties. Out of a list of about 100 recently imported varieties, the variety Lida, of Russian origin, was the only one which gave satisfactory results. The following list of best varieties is recommended for planting in the North: *Gem type.*—Oval Netted Gem, Golden Netted Gem, Netted Gem, Rose Gem, Paul Rose, and Emerald Gem. *Medium type.*—Extra Early Hackensack, Kinsman Queen, Satisfaction, Chicago Nutmeg, Improved Jenny, New White Japan, Nectar of Angels, Extra Early Cantaloupe, and Acme. *Large, long type.*—Granite State, Long Yellow, and Improved Cantaloupe.

Onion growing, F. A. HUNTLEY (*Idaho Sta. Bul. 22, pp. 115–127, figs. 8*).—Methods of onion culture adapted to Idaho soils and climate

and based on three years' experience in growing onions at the station are given. Six varieties are described, and the comparative results obtained in growing the greater number of these by transplanting and from seed sown in the open field are shown in tabular form. The transplanted bulbs gave the best results in every instance. Prizetaker stood at the head of the varieties tested, whether transplanted or grown from seed in the open field. The labor involved in the two methods of onion culture are considered to be about the same. Directions for irrigating onions are given.

The Oregon prune: Its composition, food value, soil draft, G. W. SHAW (*Oregon Sta. Bul. 61, pp. 18*).—This bulletin presents the results of analyses of a large number of samples of fresh and cured Oregon prunes. Previous work of a similar character at the station (E. S. R., 9, p. 753) is reviewed. The results, showing the proportion of flesh, juice, and pits, and the composition, are tabulated and summarized. Some of these data follow.

Composition of prunes.

	Average weight.	Percentage of flesh.	Percentage of juice in flesh.	Water.	Protein.	Nitrogen-free extract (including fat and fiber).	Sugar.	Acid.	Ash.
	Gm.			*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Oregon fresh prunes (average)	29.3	94.5	81.7	77.37	1.14	21.14	2.39	0.35	0.83
Oregon fresh prunes (Petites)	22.2	94.28	78.6	72.26	1.14	25.49	13.14	.35	.76
Oregon fresh prunes (Italians)	29.8	94.39	76.4	77.07	1.09	20.56	10.82	.42	.86
Oregon dried prunes (average)				19.27	2.03	76.48			2.22
California prunes (average)				80.20	.80	18.50		.40	.50
California plums				78.40	1.00	20.10		.40	.50
Oregon cherries				81.30	.90	17.30			.50
California cherries				79.40	1.20	19.00			.40

With reference to cured prunes the author states that—

"The average of all analyses shows [Oregon] prunes to contain about seven times as much edible matter as waste (pits). The fruit which had satisfactory keeping qualities carried about 20 per cent of water. From the observations made I do not regard it as safe to leave a greater quantity of water than this in the fruit. In most cases where the fruit carried over this there was a tendency toward mold. . . . The fact that this product carries about 80 per cent of dry matter shows that it is of high food value. About three-eighths of this is composed of the carbohydrates which serve to develop energy and fat, hence prunes must be considered as essentially a fattening food and should be used with other foods rich in nitrogen."

The average results of ash analyses of prunes are given, and are discussed with reference to the draft on the soil. A fertilizer consisting of 2,000 lbs. of air-slaked lime and 400 lbs. of muriate of potash is suggested for prunes on Oregon soils.

The resistance to drought of some American vines, C. GRIMALDO (*Prog. Agr. et Vit. (Éd. L'Est), 21 (1900), No. 25, pp. 731–734*).—The relative resistance to drought of some 70 hybrids and varieties of grapes grown in both sandy and clay soils is shown in tabular form.

In general, American varieties leave much to be desired as regards their resistance to drought. European-American hybrids proved more resistant than American sorts. Some varieties of Riparia proved quite satisfactory. Rupestris suffered, especially in sandy soils. Berlandieri of the American species proved most resistant to dryness, and this quality was often found in its hybrids.

A new substitute for rubber (*Sci. Amer., 82 (1900), No. 20, pp. 309, 310*). It is reported that a substitute for rubber has been found in the extract obtained by hydrocarbon solvents from the macerated wood of a shrub growing in Central Mexico, sometimes called yule, and having the botanical name of "*Synathereœas mexicanas.*"

"The shrub grows wild on the rolling land and attains the average height of 3 ft. . . . It grows abundantly, may be easily cultivated, roots readily from cuttings, may be cut two or three times a year and immediately begins to grow, and shoots up again to form new wood. It does not belong to the plants which yield milky juices, being a comparatively hard wood and growing as a small scrubby bush, but there is found within its bark and wood a large amount of gummy matter, and upon comminuting it by cutting finely, grinding, or pounding the same, and macerating it with a hydrocarbon solvent, such as gasoline, naphtha, ether of petroleum, oil of turpentine, or the like, this gum is softened and extracted from the wood, and when extracted does not harden to crystallization, but still holding a small portion of the hydrocarbon remains as a viscid sticky mass that fulfills all of the physical conditions of crude rubber. It may be vulcanized perfectly, and is superior to most India rubber, since it is free from all mechanical impurities, and needs no preliminary cracking, grinding, and washing as does the ordinary crude rubber."

The process of maceration is described. A yield of 40 lbs. of gum, having a density at 15° C. of 0.98, is reported for each 100 lbs. of the shrub macerated. Its advantages over ordinary rubber are saving in cost of reproducing the plant, exportation, material used in purifying establishments, fuel, machinery, and time.

Plant breeding, D. R. PILLSBRY (*Florida Agr., 27 (1900), No. 38, pp. 561, 562*).—Popular presentation of some results already obtained by plant breeding.

Summary of the work of the horticultural division for the year 1899, S. T. MAYNARD (*Massachusetts Hatch Sta. Bul. 66, p. 19*).—Summarized results obtained in variety and fertilizer tests with orchard and small fruits and grapes are reported and suggestions given on thinning fruits and the pruning of fruit trees and plants. A spraying calendar concludes the bulletin. In the fertilizer tests with apples on sod, marked improvement was observed only when nitrate of soda was used.

Report of the assistant in horticulture, A. T. JORDAN (*New Jersey Stas. Rpt. 1899, pp. 131–187, pl. 1, dgm. 1*).—The fertilizer and irrigation work here reported in detail with blackberries, raspberries, strawberries, currants, gooseberries, orchard fruits, lettuce, and tomatoes is in continuation of similar work reported in 1898 (E. S. R., 11, p. 735), and has been abstracted from another source (E. S. R., 11, p. 1039). Articles included in these pages on pear growing in New Jersey and on forcing tomatoes have also been noted (E. S. R., 12, pp. 144, 146). In experiments with lettuce, radishes were grown between the rows and subject to the same conditions of soil, irrigation, and fertilizers. With this crop, surface irrigation proved better than subirrigation, and benches seem to have given better results than solid beds. Lime added to a good forcing soil resulted in considerably decreasing the yield of radishes, while nitrate of soda on the same soil in the absence of mineral fertilizers decidedly increased the yield.

Report of the horticulturist, H. L. Hutt (*Ontario Agr. Col. and Expt. Farm Rpt. 1899, pp. 87–92*).—This report covers the results obtained in tests with orchard fruits, small fruits, grapes, ornamental plants, and tomatoes. Of the grapes tested, Moore Diamond, Worden, Early Ohio, Wyoming Red, Moore Early, and Jessica were the hardiest varieties grown. Earliest of All, Atlantic Prize, Stone, and Aristocrat were the most satisfactory tomatoes grown.

The best cantaloup for the Paris market, L. Meslé (*Rev. Hort., 72 (1900), No. 16, pp. 464–466, figs. 3*).—Different forms of the Large Prescott variety are noted and the qualities sought by the trade in cantaloupes pointed out.

Lettuce culture under canvas, H. G. Fletcher (*Florida Agr., 27 (1900), No. 35, p. 520*).—A popular presentation of cultural details involved.

Onions, R. H. Garrahan (*Tennessee Sta. Rpt. 1899, pp. 64–66*).—Popular cultural directions for growing onions and onion sets.

New Zealand spinach as a garden crop, H. C. Irish (*Proc. Soc. Prom. Agr. Sci. 1899, pp. 30–34*).—The nature of this plant, known also as New Zealand iceplant (*Tetragonia expansa*), its use for greens, and methods of culture are discussed. The seeds are slow of germination, requiring from 3 to 4 weeks' time, and seeds more than a year old require from 3 to 4 times as long for germination. Soaking the seed in warm or boiling water for various lengths of time had but little influence in hastening the period of germination. Each plant will furnish about a peck of greens a week and continue to furnish a supply until heavy frosts.

Tomato products, E. Bonavia (*Sci. Amer. Sup., 49 (1900), No. 1268, p. 20333*).—The uses of fresh tomatoes; Italian tomato preserves; tomato chutney—a kind of relish for curries, cold meat, and fish; tomato sauce; and green tomato jam are noted, recipes being given for making.

The cultivation of yams (*Queensland Agr. Jour., 7 (1900), No. 1, pp. 58–60*).—Several species of tropical yams (*Dioscorea* spp.) are described and cultural directions given.

Orchard management, J. C. Blair (*Illinois Sta. Bul. 59, pp. 371–396, figs. 9*).—Popular directions for the cultivation, pruning, fertilizing, and spraying of orchards, with notes on fungicides and spraying machinery. The bulletin is written with special reference to Illinois conditions.

The renovation of unproductive orchards. Why are old orchards unproductive? C. A. Keffer (*Tennessee Sta. Rpt. 1899, pp. 57–61, fig. 1*).—Popular discussion of this subject, with suggestions regarding the time, method, and purpose of pruning.

Fertilizers for the orchard, C. A. Mooers (*Tennessee Sta. Rpt. 1899, pp. 61–64*).—The necessity for orchard fertilization is pointed out, and the principles involved in the use of nitrogen, potash, and phosphoric acid in the orchard are noted.

The manuring of fruit trees, R. Brunet (*Jour. Agr. Prat., 1900, II, No. 34, pp. 277–280*).—A general discussion of the principles involved.

Irrigation in fruit growing, E. J. Wickson (*U. S. Dept. Agr., Farmers' Bul. 116, pp. 48, figs. 8*).—A popular discussion of the relation of irrigation to fruit production and of irrigation methods. The work is based on Pacific Coast experiences and deals with all the more important phases of diverting, pumping, storing, and applying water to orchard fruits when grown on different soils and under different climatic conditions.

Observations on packing and transport of plants, fruits, and seeds, J. H. Hart (*West Indian Bul., 1 (1900), No. 3, pp. 296–305, figs. 3*).—Diagrams and descriptions are given of 3 different forms of packing cases for plants. Fruit and seed packing and shipping are also considered.

Storing apples for exposition (*Amer. Gard., 21 (1900), No. 290, p. 470*).—This article has been abstracted from another source (E. S. R., 11, p. 849).

Notes on figs under glass (*Jour. Hort., 52 (1900), No. 2710, p. 220*).—Cultural and fertilizer notes.

Mangoes (*Bul. Bot. Dept. Trinidad, 1900, No. 24, pp. 257-271, figs. 7*).—Seven promising sorts of mangoes growing in the botanical gardens are illustrated in outline and described.

Pineapple culture, T. COOMBER (*Garden, 58 (1900), No. 1496, p. 48*).—Directions for the culture of this fruit under glass.

Fertilizers for pineapples (*Bul. Bot. Dept. Jamaica, n. ser., 7 (1900), No. 3-5, pp. 39-45*).—In experiments with different fertilizers in Jamaica the use of 550 lbs. of cotton-seed meal supplemented with 100 lbs. of high-grade sulphate of potash at time of flowering has given the best results. The use of phosphoric acid for pineapples has been without any effect whatever. A review is given of Rolfs' experiments in fertilizing pineapples in Florida (E. S. R., 11, p. 739).

Protection of small fruits from frost, J. W. SMITH (*Jour. Columbus Hort. Soc., 15 (1900), No. 2, pp. 89-91*).—The use of various coverings, smudges, etc., for protection against frosts are considered.

Notes on varieties of the strawberry, W. R. LAZENBY (*Jour. Columbus Hort. Soc., 15 (1900), No. 2, pp. 94-97*).—The characters which an ideal strawberry should possess are noted and an account given of the growth of 11 of the newer varieties fruited on the Ohio State University grounds in 1900.

Strawberries in Ohio, M. CRAWFORD (*Amer. Gard., 21 (1900), No. 300, pp. 629-631*).—As the result of tests the author concludes that "those who want the largest, best, and most beautiful berries should grow the Marshall for early, Gandy or Empress for late, and the Wm. Belt, Downing Bride, Sample, Nick Ohmer, and Margaret. Those who want 'good berries and lots of them' should grow August Luther or Johnson Early for early, Klondike or Hunn for late, and Senator Dunlop, Wm. Belt, Sample, McKinley, Warfield, and Ridgeway." For big berries for market the additional list of Clyde, Bubach, Haverland, Parker Earle, and Parsons Beauty are recommended.

Grape growing in the South, S. M. TRACY (*U. S. Dept. Agr., Farmers' Bul. 118, pp. 32, figs. 6*).—Under this heading the author discusses the location of the vineyard, methods of propagation, selection of varieties, planting, cultivating, fertilizing, pruning, training, and gathering the fruit. Notes are also given on the insects and diseases of grapes and suggestions as to methods for their control.

Green manures in vineyards, A. CARRÉ (*Prog. Agr. et Vit. (Éd. L'Est), 21, (1900), No. 11, pp. 322-327*).—The value of the practice and of different plants for the purpose are considered.

Grafting resistant vines, F. T. BIOLETTI (*Pacific Rural Press, 60 (1900), No. 4, p. 52*).—A controversial article in which the superiority of grafting in the field over bench grafting resistant vines is questioned. "While this superiority may be real with regard to Lenoir and other similar stocks, it is doubtful with regard to Riparia varieties, and almost certainly not true with respect to all Rupestris varieties."

The irrigation of vineyards, P. FERROUILLAT (*Prog. Agr. et Vit. (Éd. L'Est), 21 (1900), No. 18, pp. 524-531*).—This article is largely devoted to a discussion of the size of the ditches, tiles, and wells needed in irrigating vineyards.

Caoutchouc or India rubber: Its origin, collection, and preparation for the market, etc., J. C. WILLIS (*Roy. Bot. Gard. Ceylon Circ., 1. ser., 1899, No. 12-14, pp. 105-168, figs. 4*).—The results of a number of experiments in tapping, collecting the latex, and preparing the rubber for the market are included in the circular.

Commercial culture of caoutchouc, F. HERBET (*Manual de culture pratique et commerciale du caoutchouc. Paris: J. Fritsch, 1899, pp. 138, figs. 38*).

Caoutchouc-producing plants, P. VAN ROMBURGH (*Teysmannia, 11 (1900), No. 1, pp. 16-24*).—*Willughbeia firma*, belonging to the Asclepiadaceæ, is common in the East Indies and produces an abundance of caoutchouc of fair quality. It is a climber

with short-stalked leathery leaves and small white flowers. A vine $6\frac{1}{2}$ years old may be expected to yield 100 gm. of marketable caoutchouc.

Willughbeia tenuifolia is common with the former species and produces a gutta-percha of inferior quality.

The product of *Willughbeia firma* is not equal to that of *Ficus elastica* but a greater quantity is produced by crushing the sections of stem after the flow of sap has ceased. Special factories have been built to crush the stems and prepare the product for market.—H. M. PIETERS.

About vanilla (*Boston: Joseph Burnett Co., 1900, pp. 44, figs. 9*).—Popular account of the habitat, history, culture, and curing of the orchid producing the vanilla bean.

Experiments with lawn grasses, B. D. HALSTED (*New Jersey Stas. Rpt. 1899, pp. 409, 410*).—A report is given of 9 plats of grass which were seeded in 1896, in which 9 different species of grass are compared for lawn purposes. Notes are given upon the relative value of each. Based upon the experiments of 4 years, the author suggests as a satisfactory lawn mixture Rhode Island bent grass, Kentucky blue grass, redtop, and perennial rye grass.

American floriculture, retrospective and prospective, B. T. GALLOWAY (*Florists' Exchange, 12 (1900), No. 36, pp. 868, 869*).—Historical and statistical review.

Ornamental trees and shrubs, W. R. LAZENBY (*Jour. Columbus Hort. Soc., 15 (1900), No. 2, pp. 63–68*).—Paper read before the society at its April meeting. It discusses the planting of trees and shrubs for home grounds, public grounds, and roadsides.

Ornamental climbers, W. R. LAZENBY (*Jour. Columbus Hort. Soc., 15 (1900), No. 2, pp. 85–88*).—A number of annuals and perennials are noted, their characters being given.

Status of the rose, E. G. HILL (*Amer. Gard., 21 (1900), No. 297, pp. 583, 584*).—The author holds that in order for the rose to hold the same high place in American gardens that it does in English and continental gardens it must first be freed from the fungus disease known as the "black spot." If this can not be done a new race of roses must be built up by crossing the hardier species with our present highly developed Tea and Hybrid Tea varieties. For forcing purposes varieties with new colors are needed—something "like Gen. Jacqueminot, or Rodocanachi, or a variety with the tint and fragrance of Marechal Niel combined with the fine practical qualities of Bride or Bridesmaid."

The best sweet peas (*Amer. Gard., 21 (1900), No. 299, p. 612*).—Some of the most popular exhibition varieties of sweet peas at the recent Sweet Pea Conference in London in the decreasing order of merit were: Blanche Burpee, Mars, Lovely, Navy Blue, Triumph, Mrs. Eckford, Princess of Wales, Queen Victoria, Lady Grisel Hamilton, America, Black Knight, Salopian, and Sadie Burpee. A list is given showing the merits of each variety in the entire competitive display.

The classification of sweet peas (*Amer. Florist, 16 (1900), No. 637, pp. 56, 57*).—A list is given of sorts adjudged the most distinct and also of those which have received awards from the Royal Horticultural Society.

SEEDS—WEEDS.

The germination of seeds as affected by certain chemical fertilizers, G. H. HICKS (*U. S. Dept. Agr., Division of Botany Bul. 24, pp. 15, pls. 2*).—A series of investigations are reported, in which the effect of immediate application of certain chemical fertilizers to seeds is shown by the germination and growth of the seedlings.

Previous investigations in this line are reviewed and an outline of the author's experiments is given, in which it is claimed that ferti-

lizers are generally supposed to influence the swelling of the seed, the nature and availability of the reserve material, the awakening and growth of the embryo, and the young sprout before it reaches the surface of the soil. A large number of experiments were conducted with wheat, lettuce, radish, and crimson clover seed grown in soil in a greenhouse. The fertilizers used were nitrate of soda, muriate of potash, boneblack, oyster-shell lime, and a mixed fertilizer consisting of boneblack, muriate of potash, and nitrate of soda. These different substances were drilled in the rows in which the seeds were planted and also mixed with the soil. In the tabular results it is shown that in many cases, if not in most, the application of the fertilizer directly in the row had detrimental effects, and the injurious influence was exerted upon the sprout after it had passed through the seed coats. The author's summary of his results is as follows:

"(1) That muriate of potash and sodium nitrate used as fertilizers in strengths of 1 per cent or more are very detrimental to the germination of seeds, whether applied directly or mixed with the soil.

"(2) That fertilizers composed of phosphoric acid or lime are much less injurious to germination than sodium nitrate or muriate of potash, and if not used in excess may be harmless.

"(3) That commercial fertilizers should not be brought into direct contact with germinating seeds.

"(4) The effect of treating seeds with chemicals before planting is no index to the action of those chemicals when applied as manure to the soil.

"(5) That the chief injury to germination from chemical fertilizers is inflicted upon the young sprouts after they leave the seed coat and before they emerge from the soil, while the seeds themselves are injured only slightly or not at all.

"(6) It is highly improbable that potash, phosphoric acid, nitrogen, or lime used as fertilizers actually favor germination."

Investigations on the rôle of oxygen in germination, P. Mazé (*Ann. Inst. Pasteur, 14 (1900), No. 5, pp. 350–368*).—The author has investigated the effect of submersion on the germinative power of seed and also the diastatic action produced by such treatment. Peas, maize, lupines, peanuts, colza, cabbage, lucern, and clover were studied.

The failure to germinate on the part of submerged seed was found to be due to a lack of aeration. The hydrolyzing enzyms, especially zymase, continued their activity, but the oxidizing diastases were unable to produce the liquefied condition necessary for the elaboration of the reserve material, and as a result the embryos remained dormant. In the case of small seeds, such as the crucifers, it was found that they were able to develop slowly, the air content of the seeds being sufficient to supply the oxygen necessary for respiration. Starchy seeds were found to lose their germinative ability sooner than oily ones when submerged, but there is nothing to indicate that any kind of seed can long endure such a state.

The actual diminution of vitality of seeds which have been submerged in water is said to be largely due to the production of poison-

ous compounds, particularly aldehyde, in the surrounding liquid. The temperature at which the experiments were carried on was found to have an important bearing on the results.

The destruction of weeds in cereal crops by means of solutions of chemicals sprayed upon the foliage, H. L. BOLLEY (*Proc. Soc. Prom. Agr. Sci. 1899, pp. 107-109*).—The author reports having made in 1896 attempts to destroy the English charlock by means of a solution of corrosive sublimate sprayed over oat fields. The strengths of solutions selected and the weather conditions were such that the experiment was a failure.

In 1899 the author conducted a series of experiments for the destruction of weeds over large areas by spraying the crops with different solutions and in the present paper he reports upon the effect of copper sulphate as a weed destroyer. The effect of a 10 per cent solution of copper sulphate sprayed over wheat is stated. At the time of the spraying, the wheat was 3 to 5 in. in height and the portion of the field selected for the experiment was exceedingly weedy, the principal weeds being charlock, wild barley, wild rose, penny cress, shepherd's purse, wild buckwheat, lamb's quarter, and the great ragweed. This application was made June 1 and on August 8 all the weeds except the wild rose and older plants of penny cress had been destroyed. The wheat leaves were burned slightly at the tip, but the yield was considerably larger than that of an adjoining untreated plat. A number of tests were made with a 1 per cent solution of copper sulphate which was found to kill the great ragweed and charlock but failed to destroy the older plants of penny cress. June 20 an oat and mustard field was sprayed with copper sulphate at the rate of 1 lb. to 4 gal. of water. The oat plants were about 6 in. high, the mustard about equaling it or in some places a little higher. On August 1 the crop on the treated area was entirely free from weeds except for pigeon grass and wild rose. The plants were stalky and well stooled. Upon the untreated area the plants were weak and failed to stool, and the crop was considered at least $\frac{1}{3}$ less than upon the treated plat. The amount of liquid used in the author's experiments was approximately 40 gal. per acre, and he believes the results indicate that spraying to destroy weeds in cereal crops can be carried out on an economic basis.

Seed selection, P. O. VANATTER (*Tennessee Sta. Rpt. 1899, pp. 75, 76, fig. 1*).—Popular notes are given on the advantages derived from the use of clean seed and also the value of selected seed in the improvement of crops.

Clover seed, A. D. SELBY (*Ohio Sta. Spec. Bul. 4, pp. 7, figs. 31*).—Notes are given on the vitality, purity, and manner of testing clover seed. A number of the more common weed seeds found in samples of clover seed are figured by means of photoengravings. Detailed reports are given on the analyses of 15 samples of clover seed purchased in the market, and comparisons are drawn between the market price and the actual value of the seed.

Some methods of seed investigation, L. von Thaisz (*Bot. Centbl., 82 (1900), No. 9, pp. 269, 270*).—Different methods for treating refractory seed before placing them in the germinating chamber are discussed. For such seeds the author recommends soaking in water, after which they are heated in weak caustic potash and then neutralized with acetic acid.

Regulations and standards of the Vienna seed-control station, T. Ritter von Weinzierl (*Pub. K. K. Samen-Control-Sta. Wien, No. 208, pp. 23*).

Rules for agricultural wholesale dealers of seeds and feeding stuffs, T. Ritter von Weinzierl (*Pub. K. K. Samen-Control-Sta. Wien, No. 205, pp. 23*).

Composition of grass-seed mixtures, T. Ritter von Weinzierl (*Pub. K. K. Samen-Control-Sta. Wien, No. 207, pp. 48*).—A third edition of the author's bulletin on grass-seed mixtures. Suggestions are given for making grass mixtures for different purposes and the amount of seed required per hectare.

Some difficult germinations, N. Bernard (*Rev. Gén. Bot., 12 (1900), No. 135, pp. 108-120*).—Results are given of a study of the germination of a number of seeds and spores of plants whose subterranean parts are normally inhabited by endophytic fungi. The plants studied were several species of orchids, lycopodiums, and ferns.

Resistance of seeds to mercury, C. De Candolle (*Arch. Sci. Phys. et Nat., 8 (1899), pp. 517, 518; abs. in Jour. Roy. Micros. Soc. [London], 1900, No. 2, p. 222*).—Grains of wheat, after being submerged for 4 years in mercury, were germinated and produced normal plants.

Nineteenth annual report of the Vienna seed-control station, T. Ritter von Weinzierl (*Jahresber. K. K. Samen-Control-Sta. Wien, 1900, pp. 32*).—Gives a report of the activity of the station for the year ended July 31, 1899. During this period 25,763 analyses were made, as well as field and laboratory investigations upon a number of topics, as grass mixtures; experiments with Nitragin and Alinit; and studies of clover, beet, flax, tree, and cereal seeds. The usual data as to purity, germinative ability, etc., are given in tabular form.

The vitality of weed seeds twenty years in the soil, W. J. Beal (*Proc. Soc. Prom. Agr. Sci. 1899, pp. 86, 87*).—This article has been previously noted (E. S. R., 11, p. 856).

New weed arrivals, W. Lochhead (*Ontario Agr. Col. and Expt. Farm Rpt. 1899, pp. 37-39, figs. 3*).—Descriptive notes are given of 2 weeds which have made their appearance in Ontario, and it is thought possible may become troublesome. They are prickly lettuce (*Lactuca scariola*) and the broad-leaved gum plant (*Grindelia squarrosa*).

Experiments with weeds, B. D. Halsted (*New Jersey Stas. Rpt. 1899, pp. 407, 408*).—In continuation of experiments outlined in a previous report (E. S. R., 11, p. 749), the author has conducted his investigations on the ability of weeds to withstand or encroach upon each other. These experiments have been conducted for 3 seasons. The most aggressive weeds at the present time are *Ambrosia artemisiæfolia*, *Polygonum persicaria*, *Syntherisma* [*Panicum*] *sanguinalis*, *Rumex acetosella*, and *Alsine media*.

The extermination of weeds, E. W. Hilgard (*California Sta. Circ., Sept., 1898, pp. 3*).—Brief rules are given regarding the principles of weed extermination.

The passing of the Russian thistle, C. E. Bessey (*Proc. Soc. Prom. Agr. Sci. 1899, pp. 83-85*).—This paper has been previously noted (E. S. R., 11, p. 858).

Destruction of Cardamine pratensis, L. Grandeau (*Jour. Agr. Prat., 1900, I, No. 21, pp. 742, 743*).—Notes the destruction of this weed by spraying with copper sulphate. The author advised the substitution of iron sulphate for copper sulphate on account of the possible injury to stock eating herbage that contained considerable of the copper. Analyses of samples of mixed herbage that had been sprayed with copper sulphate showed about 3.94 gm. of copper sulphate to 10 kg. of forage.

The destruction of troublesome cruciferous plants, A. Vilcoq (*Jour. Soc. Agr. Brabant-Hainaut, 1899, pp. 718, 719*).

Destruction of charlock by spraying with solutions of iron and copper sulphate, C. Journée (*Agronome, 1899, pp. 435, 436*).

The destruction of thistles and charlock by ammonium sulphate, G. Castel-Delétrez (*Jour. Roy. Soc. Agr. L'Est Belg., 1899, p. 199*).

Charlock spraying (*Ann. Rpt. Field Expts. Irish Agr. Organization Soc., 1 (1899), pp. 43–46*).—Results of spraying experiments with iron and copper sulphate solutions for the destruction of charlock in barley fields are given. A solution of copper sulphate, 3 or 4 per cent, at the rate of 40 gal. per acre gave the best results. Stronger solutions injured the barley to some extent. Dock and thistles were injured, but not killed by the spray.

Recent experiments in combating charlock, L. Grandeau (*Jour. Agr. Prat., 1900, I, No. 15, pp. 525–527*).—A 12.5 per cent solution of iron sulphate sprayed over weed-infested crops at the rate of about 200 liters per acre is said to destroy charlock, mustard, wall flower, and ground ivy, without injury to cereals, clovers, colza, and lupines.

Combating field mustard, T. Ritter von Weinzierl (*Pub. K. K. Samen-Control-Sta. Wien, No. 199, pp. 1–3*).—Recommends spraying fields with a 15 per cent solution of iron sulphate at the rate of 40 to 50 gal. per acre.

DISEASES OF PLANTS.

Report of the botanist, B. D. Halsted (*New Jersey Stas. Rpt. 1899, pp. 323–419, figs. 16*).—The principal lines of experimentation reported upon are investigations on truck crops, of which turnips, potatoes, beans, tomatoes, and eggplants have been foremost. The soil treatments for club-rooted turnips and scabby potatoes and beets have been continued, while the spraying experiments of the station were confined to Bordeaux mixture and soda-Bordeaux mixture.

Soil fungicides for potato and turnip diseases (pp. 326–367).—In continuation of the experiments reported previously (E. S. R., 11, p. 751), the author reviews 6 years' experiments with potatoes in which was sought the means for the prevention of the potato scab. Differences are noted in the susceptibility of different varieties to this disease, and in the experiments conducted the author states that sulphur gave the best results, although the showing for this season was not very striking. An investigation was conducted in this connection to determine the susceptibility of other plants to these diseases, in which 9 species of plants belonging to the same botanical order as the potato and a number of other plants were grown on infested soil. With the exception of the radishes, beets, and potatoes, no scab was noted. Experiments on soil inoculation with the potato-scab fungus showed that the steam heating of potatoes for 20 minutes destroyed the fungus only to a limited extent, while there was almost entire absence of scab where the tubers were fed to cattle and the manure placed upon the land where potatoes were grown.

Experiments with soil rot of sweet potatoes (E. S. R., 11, p. 753) indicate that 300 or 400 lbs. of sulphur and kainit per acre will give

good results in combating this disease. Experiments with club root of turnips (E. S. R., 11, p. 750) have been continued, indicating that the application of 35 to 50 bu. of air-slaked lime per acre is a practical remedy. Irrigation seems to favor the development of this disease, and shading has but little effect upon it. The indications are that the germs of the disease will exist for a long time in the soil, even when weeds, upon which it abounds, are absent. Soil may be inoculated by using infested turnips, either applied directly or as manure from animals to which the clubbed turnips have been fed.

Experiments with Nitragin and other germ fertilizers (pp. 367–379).—A report is given of experiments in which Nitragin and Alinit were tested on a number of crops. The Nitragin experiments were conducted upon 11 varieties of leguminous plants, none of which gave particularly striking results in favor of the substance. As a possible explanation the author states that on the roots of all plants, both treated and untreated, tubercles were abundant, indicating the presence of a considerable amount of the organisms in the soil. Experiments with Alinit were conducted on a number of plants, but the results obtained gave no indication of any advantage in its use. An experiment was conducted with various substances which were thought to have an effect upon the germs in the soil whereby their growth and reproduction would probably be stimulated. The materials used were agar, egg albumen, asparagin, diastase, dextrin, and dyspepsin. The plants tested were peas, beans, and oats. There seems to have been no influence exerted on the crops by the different substances employed.

Experiments with beans (pp. 379–386).—In continuation of previous experiments (E. S. R., 11, p. 751), the author reports results with the eleventh and twelfth crops of beans grown continuously upon the same soil. Spraying experiments were conducted, but as the crop was free from disease there was little difference between the treated and untreated plats. This was true both where the soil was sprayed and where the plants were sprayed with fungicides. Experiments in planting beans at various depths of from 1 to 5 in. showed little difference between the shallower plantings; beans planted 5 in. deep did not grow.

Experiments with Lima beans and peas are reported in which the effect of treatment and planting on new soil was noted.

Experiments with tomatoes (pp. 387, 388).—Two varieties of tomatoes were planted upon soil which had borne tomatoes for the sixth successive time. Some of the plants were sprayed with Bordeaux mixture and soda-Bordeaux mixture. But as there was little fruit rot the results of spraying are not very striking. A considerably greater amount of green fruit was obtained at the end of the season from the sprayed than from the unsprayed plants.

Experiments with eggplants (pp. 388, 389).—The fifth consecutive

crop of eggplants is reported upon, but the yield of fruits was so small that conclusions can not be drawn from the investigation.

Experiments with cucumbers (p. 390).—Two varieties of cucumbers are reported upon which were sprayed with the fungicides above mentioned, in which Bordeaux mixture gave the better results. The effect of soil inoculation, in which soil from an area on which cucumbers had been previously grown was transferred to the hills, was investigated without any results.

Experiments with lettuce (pp. 390, 391).—Plats of Boston Market and Wonderful lettuce were sprayed with Bordeaux mixture and soda-Bordeaux mixture, 8 applications being given them. The rot was observed in the crown of the Wonderful early in July, and even the sprayed plants were not wholly exempt from it. At this time the other variety was in bloom and did not show any evidence of disease. The leaf spot (*Septoria lactucæ*) was somewhat abundant, but, as it did not appear until after the plants had passed the marketable stage, was of little consequence. Inoculation experiments were conducted in which soil from an old lettuce bed was distributed evenly among the open rows in soil that had not previously grown lettuce. The experiment demonstrated that the leaf spot can be readily transmitted in this way.

Experiments with onions (p. 392).—A brief report is given upon experiments with onions grown for the third consecutive year on the same soil for the purpose of studying onion smut and other diseases. The crop was nearly a failure, and there was no smut on any of the plants where the disease had been introduced the previous year.

Experiments with beets (pp. 392, 393).—The author investigated the susceptibility of beets to the potato scab and also studied the influence of soil treatment upon its prevalence. The beets were severely infested with scab before the roots were large enough for table use. There seemed to be little difference in the susceptibility of the different varieties tested. The soil treatment appeared to indicate that the best results were obtained from the use of sulphur and then only after it had been in the soil for more than 1 year.

Experiments with sweet corn (pp. 393–395).—Experiments were conducted with Black Mexican and Egyptian corn in which cross fertilization of the 2 varieties was shown.

Experiments with Swiss chard and New Zealand spinach (pp. 395–398).—Experiments are reported with these vegetables in which Bordeaux mixture was used for preventing their diseases, especially in the case of the former. The results obtained were entirely favorable to the use of the fungicide.

Experiments in winter ridging of the soil (pp. 398–402).—Experiments are reported in which the effect of ridging the soil during the winter or allowing it to lie flat as shown by the occurrence of various

diseases are reported. The plants experimented with were tomatoes, turnips, potatoes, bush beans, peas, chard, Lima beans, and beets. The ridging of the soil for the added exposure does not show any marked advantage. There was a slight gain in the amount of crop with beets, bush beans, peas, and turnips, but an actual loss in case of tomatoes, potatoes, and Lima beans.

Experiments with spraying (pp. 402–404).—The formulas for the fungicides used in the foregoing experiments are given and the details of the experiments are briefly reviewed. So far as opportunity offered for comparison, the soda-Bordeaux mixture was about equal to the Bordeaux mixture in its efficiency.

Experiments with soil inoculation (pp. 406, 407).—These experiments were conducted with beans, peas, corn, Lima beans, cucumbers, lettuce, and tomatoes; with the exception of the lettuce, as noted above, there was little evidence that plant diseases can be transported by the method pursued.

Experiments with ornamental plants (pp. 408, 409).—Brief notes are given on experiments with a number of ornamentals, most of which were almost wholly free from fungus attacks.

Experiments with asparagus rust (pp. 410–413).—The author gives an account of the present season's investigations in spraying as a preventive of asparagus rust in continuation of experiments previously reported (E. S. R., 11, p. 753). Bordeaux mixture was the only fungicide used, and 5 applications were given during June and July. In August a number of plants were noticed to be injured by the fungicide, and half strength solution was used during August and September. A difference of 16.9 per cent was noticed in favor of sprayed plants. Observations made in the field seemed to indicate that the rust has not proved as harmful to the asparagus industry as was first expected. Clean culture and the use of commercial fertilizers have tended to produce a strong growth, so that the plants escaped serious injury.

Experiments with pear blight (pp. 414–417).—The third year's experiments with pear blight are reported. The results agree with those previously given (E. S. R., 11, p. 753), in that summer-pruned trees yielded better than others, but there is little in the way of conclusions to be drawn from the experiments thus far conducted.

Brief notes are given on the forcing of peaches attributed to causes similar to, if not identical with, peach yellows and on fungi as related to weather. During the season covered by the report there was an unusual precipitation in February and March, followed by a drought in April and May. As a result there was but slight occurrence of fungus diseases early in the season.

Cultures of Uredineæ in 1899, J. C. ARTHUR (*Bot. Gaz., 29 (1900), No. 4, pp. 268–276*).—An outline is given of studies made by the author on the relationship between the æcidial and teleutospore forms

of a number of rusts. The experiments were, with a single exception, conducted in the greenhouse upon potted plants and, where the inoculation had been successfully made, results appeared in from 6 to 14 days.

Inoculations with the teleutospores of *Puccinia phragmitis*, a common species of rust on *Phragmitis communis*, when sown on *Rumex crispus* and *R. obtusifolia*, produced abundant æcidia. Teleutospores of *Puccinia convolvuli* sown upon *Convolvulus sepium* produced æcidia, showing that this species of rust is autœcious. Æcidiospores from *Æcidium urticæ*, sown upon leaves of *Carex stricta*, in 11 days produced uredospores of *Puccinia caricis*. Sowings on another species of Carex failed to produce infection. Æcidiospores from *Euphorbia nutans* were sown upon that species, as well as upon *Euphorbia maculata*. The uredo occurred on *Euphorbia nutans*, followed by teleutospores. While not conclusive, the author thinks this indicates that *Uromyces euphorbiæ* is an autœcious species. Teleutospores of *Phragmidium speciosum* sown upon cultivated roses gave a Cæoma indistinguishable from *Cæoma miniata*, and it is assumed that the American rose Cæoma belongs wholly to *Phragmidium speciosum*. *Triphragmium ulmariæ*, according to the author, a hitherto unknown rust in America, failed to produce infection except when sown upon *Ulmaria rubra*. Teleutospores of *Puccinia americana* from *Andropogon scoparius*, when sown upon *Pentstemon pubescens*, produced æcidia, and reciprocal infections of *Andropogon scoparius* with æcidiospores from Pentstemon were successfully made. Spores of *Æcidium lycopi*, sown on *Scirpus atrovirens*, produced the uredo form of *Puccinia angustata*. *Puccinia windsoriæ*, a very common rust on *Triodia cuprea*, is proved to be connected with the *Æcidium pteleæ* of *Ptelea trifoliata* by successful inoculations. The relationship between *Puccinia vilfæ* and *Æcidium verbenicola* is established by production of the uredo form of *Sporobolus longifolius* when inoculated with æcidiospores from *Verbena stricta*. In a similar way, connection between *Puccinia peridermiospora* and *Æcidium fraxini* is established, the teleutospores of the Puccinia readily producing the æcidia when sown upon *Fraxinus viridis*.

The smuts of Illinois agricultural plants, G. P. CLINTON (*Illinois Sta. Bul. 57, pp. 289–360, pls. 10*).—The author gives the results of studies made during the past 5 years to ascertain the kind of smuts infesting cultivated plants, the injuries inflicted by them, their life histories, and the most practical methods of preventing their ravages. The general structure of smuts is described, and directions given for their prevention.

Loose and hidden smuts of oats (pp. 297–316).—These 2 smuts, due to *Ustilago avenæ* and *U. levis*, have been under investigation, but the prevention and infection experiments were mainly confined to the

latter. The life histories of the fungi are described at some length, their effect on the host plants are stated, and the results of extended investigations to ascertain the percentage of damage done are given. The author concludes that about 6 per cent of the crop is annually destroyed by these diseases.

Investigations are reported on the effect of different times and depths of seeding on smut infection. The investigations seem to indicate that late planting tends to reduce the percentage of smut, while broadcasting the seed gave the lowest amount of the disease. In the case of seed broadcasted and lightly covered, the average amount of smut was 2 per cent. Seed covered to a depth of 1 in. averaged 6 per cent; 4 in., 10 per cent.

Investigations for the control and prevention of smut showed hot water and formalin proved the most efficient of the means tested. The author thinks the best procedure in most cases would probably be to treat only enough grain to obtain clean seed for another year.

Smut of tall oat grass (pp. 316, 317).—This smut (*U. perennans*), which was formerly thought to be identical with that of oats, is said to be less destructive to the flower parts of the grass than the loose smut of oats. The host plant of this species is not very commonly grown in Illinois, consequently the smut is of comparatively little importance.

Loose and covered smuts of barley (pp. 317, 318).—These 2 smuts (*U. hordei* and *U. nuda*) have been until recently considered the same species, the general appearance leading to this supposition. Both forms gain entrance to the host through the young tissues of the germinating seed. It has been shown that the spores falling between the open glumes are the chief source of infection and it is thought likely that with the loose smut the spores germinate and infect the seed coats with a hibernating mycelium which produces the disease the next year. On this account ordinary methods of treatment will prove failures.

Loose smut of wheat (pp. 318, 319).—This smut (*U. tritici*) is closely related, as its life history shows, to the smut of barley. An investigation by the author showed in 2 fields losses due to this source of 5 and 15 per cent, respectively. The author has conducted no experiments for its prevention but, based upon other recommendations, he suggests soaking the seed 4 hours in cold water, letting it stand 4 hours more in the wet sacks, and then treating it with hot water (133° F.) for 5 minutes. This treatment will probably kill some of the seed, hence about 1½ times the normal amount should be seeded.

Stinking smut of wheat (pp. 319–321).—This characteristic smut (*Tilletia fœtens*) is comparatively well known and frequently very destructive. Hot-water treatment, as shown by experiments at the station, proved very efficient in its control.

Smut of Indian corn and teosinte (pp. 321–335).—The smut of these 2 plants infests the host on almost any part except the silk of the ears

and the underground roots. The general effect of the smut upon the host is described, and data cited from which it is concluded that the loss to the corn crop in the State amounts annually to about 2 per cent. Numerous experiments are cited for the prevention of the disease, showing that it can not be controlled by seed treatment. The corn smut seems to be more dependent upon its sporidia for its infection than any other smut of cereals. Infection takes place rarely, if at all, through the germinating seed, but is aerial and local. Winds serve as the carrying agent for the sporidia of the plants and land can not be selected that will be entirely free from smut. It is suggested that by avoiding the use of manure, planting the crop where smutted crops have not been grown the previous season, and careful cultivation would reduce the amount of smut to a minimum. Mutilation of plants at certain stages of their growth tends to largely increase the amount of smut. This is particularly true in the case of topping. Some observations indicate that different varieties of corn vary in their susceptibility to the disease, but this point must be confirmed by further experimental work.

Grain smut of sorghum and broom corn (pp. 335–346). The grain smut of sorghum and broom corn (*Cintractia sorghi-vulgaris*) has been investigated at considerable length by the author. With broom corn this smut tends to produce an inferior brush, and while ordinarily fields do not have a very high percentage of smut, yet, on the whole, it is considered the worst fungus enemy of this crop. On the sorghum the smut tends to reduce the size and weight of the cane. Investigations showed that the smutted cane possessed a somewhat higher percentage of sugar, but the quantity of juice was reduced about in proportion to the reduction in the size and weight of the cane. The smut seriously affects the production of seed and, on the whole, lessens the yield of sorghum. It is recommended that sorghum and broom corn seed should be soaked for 15 minutes in water heated to 135° F. This method seems to be the most satisfactory and, as but little seed is required in planting these crops, the objection generally raised against the hot-water treatment of oats can not be urged.

Head smut of sorghum (pp. 346, 347).—This smut (*C. reiliana*) differs from the common grain smut of sorghum in converting the whole panicle into a large irregular mass. It has been reported as occasioning considerable damage in some localities, and in 1898 field experiments were conducted with a view of infecting the Orange variety of sorghum with this smut. Negative results were obtained in all the experiments, and it is thought probable that the variety was, to some extent at least, responsible for these results.

Grain smut of Hungarian grass (pp. 347, 348).—The presence of *Ustilago crameri* is noted in the spikes of cultivated millet. Generally only the lower parts of the glumes are destroyed, the fungus showing

through the thin membrane. This disease is not common, having been observed but once by the author in a field of German millet.

Leaf smut of timothy, redtop, and blue grass (pp. 348, 349).—The author reports the common occurrence in timothy, redtop, and sometimes on blue grass of *U. striæformis.* It is generally found in the late spring or early summer occurring on the leaves, sheaves, and rarely in the inflorescence. Affected plants are smaller than healthy ones and often, especially in the case of blue grass, are so inconspicuous as to be easily overlooked. The fungus is not uncommon and frequently said to do considerable damage, one estimate placing a loss of 30 per cent due to its presence.

Variations in the amount of leaf curl of the peach in the light of weather conditions, A. D. SELBY (*Proc. Soc. Prom. Agr. Sci. 1899, pp. 98–104*).—In continuation of his observations upon the leaf curl of the peach (*Exoascus deformans*) (E. S. R., 10, p. 557), the author gives an account of a study of the relationship between the weather conditions in the spring of the year and the amount of leaf curl. The data cover the seasons from 1893 to 1899. The author concludes that in northern Ohio the April weather is very largely responsible for the serious outbreaks of leaf curl. It is not prevalent there to a damaging extent except in years with cool, rainy, and cloudy weather. It is believed that the profitable spraying for leaf curl may be predicted with fair certainty from the temperature and rainfall of the first half of April.

A parasite of carnation rust, F. H. BLODGETT (*New York State Sta. Bul. 175, pp. 13, pls. 3*).—The occurrence of a fungus parasite of carnation rust in several greenhouses in New York is reported. While not naturally very effective as a check, by the use of artificial cultures or inoculations the author believes that some benefit might be derived from its presence.

The parasite, which has been determined as *Darluca filum*, is described at some length. Its presence is best determined by microscopic examination. The same fungus is said to infest the rust of asparagus, and it is suggested that by growing garden asparagus in houses a sufficient abundance of fungus might be obtained to check the ravages of the rust on the carnation.

Plasmodiophora brassicæ, S. NAWASCHIN (*Flora, 86 (1899), pp. 404–427, pl. 1; abs. in Jour. Roy. Micros. Soc. [London], 1900, No. 2, p. 239*).—A series of observations on the minute structure of this parasite and on the changes which it undergoes during its intercellular life are reported. In the amœba stage it exhibits a decidedly abnormal kind of indirect division, while in the spore-forming plasmodium the division of the nucleus is of a typical karyokinetic character. The differentiated group of infected parenchymatous cells of the host arise by repeated division of the cells first infected. In the course of the

growth of this swelling, there arise in infected cells a number of multinucleated amœba which at first do not coalesce into a plasmodium. The formation of the plasmode is preceded by characteristic changes in the structure of the amœbæ and their nuclei and takes place only after the complete exhaustion of the nutrient cell. During the vegetative period of its development the parasite does not kill the nutrient cell but simply causes hypertrophy.

Investigations of plant diseases, A. D. SELBY (*Ohio Sta. Bul. 111, pp. 93–142, figs. 12*).—This bulletin is a summary of the work carried on at the Ohio Station in the control of the fungus diseases of plants and was prepared as a part of the collective exhibit of the American experiment stations at the Paris Exposition in 1900.

Fungus foes of vegetable fruits, B. D. HALSTED (*Pennsylvania Dept. Agr. Bul. 59, pp. 39, figs. 20; Rpt. 1899, pp. 573–605, figs. 20*).—A somewhat popular bulletin treating of the more common vegetable fruits, in which their diseases are briefly described and suggestions given for their prevention.

Plant diseases investigated at the botanical laboratory of the Institute Agricole during 1899, E. MARCHAL (*Bul. Agr.* [*Brussels*], *16* (*1900*), *No. 1, pp. 9–21*).

Smut of cereals, E. THOMAS (*Bul. Roy. Soc. Agr. L'Est Belg., 1899, pp. 157, 158*).

A review of the stinking smut of wheat in Belgium in 1898, G. STAES (*Tijdschr. Plantenziekten, 5* (*1899*), *Nos. 5–6, pp. 170–176*).

Smut diseases of plants, H. VANDERYST (*Extr. Bul. Agr.* [*Brussels*], *15* (*1899*), *pp. 46*).

Wheat smut, A. BOURGUE (*Jour. Soc. Agr. Brabant-Hainaut, 1899, pp. 272, 273*).

The smuts of Bermuda grass and their distribution, P. MAGNUS (*Les ustilaginées du Cynodon dactylon et leur distribution geographique. Lons-le-Saulnier: Declume, 1899, pp. 8*).

A bacterial disease of beans, G. DELACROIX (*Monit. Hort. Belg., 1900, pp. 26, 27*).

A spot of tobacco leaves, A. SPLENDORE (*Giorn. Il Tobacco, 1899, No. 34; abs. in Centbl. Bakt. u. Par., 2. Abt., 6* (*1900*), *No. 11, p. 379*).—The spots are said to be dry, olive-brown, and irregular and contain the mycelium of a fungus. Leaves placed in a moist chamber developed an Alternaria indistinguishable from *A. tenuis* and a Macrosporium. Whether the fungi were the cause of the spots was not determined. In Java a similar disease is common and is most abundant during rainy seasons.

Influence of seed parasites on the growth of sugar beets, J. STOKLASA (*Sucr. Belge, 28* (*1899*), *pp. 105–108*).

A bacterial rot of onions, F. C. STEWART (*Proc. Soc. Prom. Agr. Sci. 1899, pp. 43–46, pls. 2*).—The substance of this paper has been already noted (E. S. R., 12, p. 56).

Ergot from wild rice, R. H. DENNISTON (*Pharm. Rev., 18* (*1900*), *No. 3, pp. 118, 119*).

Two new diseases of Phlox, J. RITZEMA-BOS (*Tijdschr. Plantenziekten, 5* (*1899*), *No. 2, pp. 27–32*).—Describes attacks of *Tylenchus devastatrix*, *Septoria phlogis*, and *Leptosphæria phlogis*.

A new parasite on leaves of Vinca major, F. CAVARA and P. A. SACCARDO (*Nuovo Gior. Bot. Ital., n. ser., 6* (*1899*), *pp. 7; abs. in Bot. Centbl., 82* (*1900*), *No. 5, pp. 141, 142*).—On leaves of Vinca attacked by *Puccinia berkeleyi* the authors report finding a new Tuberculina, to which the name *T. sbrozzii* is given.

A dangerous parasite of fruit trees, J. RITZEMA-BOS (*Tijdschr. Plantenziekten, 5* (*1899*), *No. 5–6, pp. 168, 169*).—Describes *Agaricus squarrosus*.

Peach leaf curl and its prevention, G. STAES (*Tijdschr. Plantenziekten, 5* (*1899*),

No. 3-4, pp. 135-138).—Describes *Exoascus deformans* and quotes from another source (E. S. R., 10, p. 557) that spraying with Bordeaux mixture greatly reduced the amount of disease.

The serious injury to sweet cherries in the Rhine Provinces, P. Sorauer (*Naturw. Wchnschr., 15 (1900), No. 12, pp. 133-135*).

A bacterial disease of syringa, J. Ritzema-Bos (*Tijdschr. Plantenziekten, 5 (1899), No. 5-6, pp. 177-183*).—A disease of syringa which is attributed to bacteria is described. Inoculation experiments were successfully made. The organism is said to be closely related to *Bacillus fluorescens liquefaciens;* forms a yellow pigment on bouillon gelatin, and gives a slight bluish florescence.

Notes on the red rot of spruce, G. Staes (*Tijdschr. Plantenziekten, 5 (1899), No. 5-6, pp. 183-192*).—Notes the attack of *Agaricus melleus* and similar fungi on spruce and firs.

A disease of plane trees in Paris, A. Giard (*Bul. Arboricult. et Floricult., 1899, pp. 356-359*).

An epidemic disease of the common alder (Alnus glutinosa), P. Nypels (*Bul. Soc. Belge Micros., 25 (1898-99), No. 8, pp. 95-104, pl. 1*).

Combating pine leaf cast, Weber (*Forstw. Centbl., 21 (1899), No. 12, pp. 625-634*).—An account is given of experiments with Bordeaux mixture, and Bordeaux mixture with sugar and with gluten for the prevention of the leaf cast of pines caused by *Lophodermium pinastri.* The use of the first fungicide was the most successful.

Combating some coffee parasites, G. d'Utra (*Bol. Inst. Agr. São Paulo, 10 (1899), No. 11-12, pp. 778-795*).

Concerning black rot, A. Jaczewski (*Westnik Winodelia, 1899, No. 3, pp. 139-145; abs. in Centbl. Bakt. u. Par., 2. Abt., 6 (1900), No. 8, pp. 263, 264*).—The form of black rot in the Caucasus is said to differ materially from that occurring in France. The parasitism of *Phoma reniformis* in the Caucasus is affirmed. Bordeaux mixture is said to have proved the most efficient fungicide for use against black rot.

Experiments in the treatment of black rot in 1899, J. B. Senderens (*Vigne Franc., 1900, No. 1, pp. 7, 8*).

Grape white rot, B. Barna (*Bot. Centbl., 81 (1900), No. 10, pp. 331, 332*).—Notes the occurrence of *Charrinia diplodiella* in Austro-Hungary.

Combating grape mildew or oidium, J. Schuster (*Allg. Wien Ztg., 1900, No. 6, pp. 52, 53*).

The true mildew (Oidium tuckeri), J. Morgenthaler (*Aarau: E. Wirz, 1899, pp. 28; abs. in Centbl. Bakt. u. Par., 2. Abt., 6 (1900), No. 5, p. 157*).—A number of fungicides were tested with more or less success. A mixture of 1 kg. soft soap, 0.5 kg. potassium sulphid, and 100 liters water is recommended. Winter washing of the vines with either of the following mixtures is advised: 10 kg. lime, 6 to 10 kg. iron sulphate, 100 liters water; 10 to 15 per cent solution of iron sulphate; or 5 per cent solution of sulphuric acid.

Permanganate of potash for grape mildew, C. Truchot (*Vigne Amer. et Viticult. Europe, 23 (1899), No. 10, p. 300*).—Spraying vines with a mixture of 125 gm. potassium permanganate, 3 kg. lime, and 100 liters water is recommended for destroying oidium.

Causes of the stunted growth of vines, J. Perraud (*Prog. Agr. et Vit. (Éd. L'Est), 21 (1900), No. 23, pp. 667-670*).—The author discusses numerous causes for the stunted growth of grapevines, among them being fungi, physiological disturbances, etc.

Plant parasites of roses, F. Richter von Binnenthal (*Mitt. K. K. Gartenbau Gesell. Steiermark, 1900, No. 6, pp. 100-104*).

Soil fungicides for potato and turnip diseases, B. D. Halsted (*New Jersey

Stas. Special Bul. 8, pp. 43, pls. 8).—The investigations reported in this bulletin are noted on page 351 from another source.

Notes on Bordeaux mixture, G. STAES (*Tijdschr. Plantenziekten, 5* (*1899*), *No. 3–4, pp. 130–134*).—Notes are given on the relative adhesiveness of Bordeaux mixtures made by different formulas and the effect of Bordeaux mixture upon a number of varieties of potatoes. Most of the information is compiled.

ENTOMOLOGY.

The destruction of mosquitoes in the city, C. FERMI and S. LUMBAO (*Centbl. Bakt. u. Par., 1. Abt., 28* (*1900*), *No. 6–7, pp. 179–185*).—The authors give brief biological notes on the mosquitoes which most commonly infest cities. As insecticides against mosquito larvæ, the authors used petroleum and chrysanthemum powder with good success. Several substances were experimented with for the purpose of discovering means for the prevention of the too rapid evaporation of petroleum from the surface of infested water. The substances which were spread upon the surface of the petroleum for this purpose were lanolin, vaseline, tar, naphthalin, olive oil, flaxseed oil, castor oil, and lard. Vaseline and tar spread rapidly over the surface of the oil without coagulating. A large number of plant substances were tried in combination with chrysanthemum powder in the destruction of mosquito larvæ. For the destruction of adult mosquitoes the authors tried fumigation with a number of substances, among which the following gave the best results: Chloroform, turpentine and vinegar, sulphuric ether, tobacco fumes, and eucalyptus fumes. During the experiments with petroleum it was found that 5 cc. per square meter of water surface killed all mosquito larvæ. It was not found necessary to renew the kerosene upon the surface oftener than once in 14 days.

Some insects injurious to garden crops, F. H. CHITTENDEN (*U. S. Dept. Agr., Division of Entomology Bul. 23, n. ser., pp. 92, figs. 23*).—*A new vine borer of Lima beans* (*Monoptilota nubilella*) (pp. 9–17).—This insect produces gall-like swellings upon the stems of Lima beans. Its present distribution seems to be from Maryland, Virginia, and the District of Columbia southward to Florida and Alabama. The author gives a description of the species in its various stages. The insect attacks Lima bean vines at almost any point along their length, and it was observed that vigorous plants were able to survive the attack while weak ones suffered to a much greater extent. The moth deposits several eggs on each vine. The species is partly double-brooded, the second generation in the District of Columbia being a small one. The greater part of the first generation probably winters over. No natural enemies of the first generation were discovered. A single parasite was reared from a specimen of the second generation and was identified as *Omphale viridis*. The remedial measures sug-

gested are trimming and destroying terminal portions of infested vines and removing larvæ from the lower portions of the stem by longitudinal cuts.

The smaller cornstalk borer (*Elasmopalpus lignosellus*) (pp. 17-22).—Specimens of this insect have been received from Georgia, South Carolina, North Carolina, Florida, Kansas, Texas, and Maryland. The species has also been observed in Indiana. The author gives a description of the moth and of the early larval stages. The only known natural enemy of this insect is *Orgilus mellipes*. The insect has been observed hibernating in all 3 stages. The remedies suggested against this species are plowing up and burning the corn stubble or other infested material, and rotation with some crop not attacked by this species.

The pale-striped flea-beetle (*Systena blanda*) (pp. 22-29).—A description is given of the adult and larval stages. The distribution of this species includes a large portion of the country from New England to the Gulf States and west to the Dakotas and Colorado and perhaps California. The native food plants of this flea-beetle seem to be especially ragweed and cocklebur, but it has recently attracted some attention as an enemy of beans and corn. The species hibernates as a beetle, and appears in the vicinity of the District of Columbia early in June. The larvæ feed below ground and probably have a wide range of native food plants. No insect enemies of the species have been observed, but the chipping sparrow and the yellow-winged sparrow have been seen eating the adult beetles. As a remedy against this insect the author recommends spraying with Bordeaux mixture and Paris green.

Observations on the bean leaf-beetle (*Cerotoma trifurcata*) (pp. 30, 31). This species seems to be increasing in abundance and injuriousness. Serious outbreaks have been reported from various parts of Virginia, Alabama, Maryland, and Missouri.

Notes on the imbricated snout beetle (*Epicærus imbricatus*) (pp. 31, 32).—Adult beetles of this species were observed feeding on bush beans and eating the blossoms of the Lima bean. One specimen of the beetle in a rearing jar was destroyed by *Sporotrichum globuliferum*.

A new tingitid on bean (*Gargaphia angulata*) (pp. 32, 33).—This insect was reported from Auburn, Ala., as injurious to the leaves of beans. On examination it was found to be a new species, which has recently been described.[1]

The destructive green-pea louse (*Nectarophora destructor*) (pp. 33-37).—This insect has committed serious depredations on peas from Nova Scotia and Canada to Virginia and Maryland. No alternate food plant for the species has thus far been discovered. The following parasites have been reared from this species: *Praon cerasaphis*, *Aphidius fletcheri*,

[1] Canad. Ent., 31 (1899), p. 301.

and *Isocratus vulgaris*. The only remedies thus far suggested against this insect are the use of kerosene emulsion and the rotation of crops.

A note on the Mexican bean weevil (*Spermophagus pectoralis*) (pp. 37, 38).—The species is known to inhabit Nicaragua, Guatemala, Panama, Mexico, Peru, and Brazil. The eggs are deposited in considerable numbers, from 50 to 100 on each bean. It is suggested that the species may in time come to infest the Southern States.

The cabbage curculio (*Ceutorhynchus rapæ*) (pp. 39–50).—This insect is reported as injurious to cabbage, kale, turnip, and horse-radish. Its preferred native food plant seems to be hedge mustard. The author describes the insect in its different stages and gives bibliographical notes. In the hedge mustard the larvæ cut holes through the stalks as they approach maturity. Sixty or more larvæ have been observed in a single stem of this plant. The beetles were observed feeding upon cauliflower and cabbage, eating the edges of the leaves. Near Washington the beetles appear in April and deposit their eggs, preferably in the hedge mustard. The egg period varies from 5 to 8 days. The larvæ feed within the stems and leaf stalks and complete their growth in about 3 weeks. Pupation takes place under the ground, and the length of the pupal period is from 5 to 8 days. The only parasite reared from this species was *Omphala livida*. The remedies suggested include the destruction of the wild food plants of the species used as trap crops, the use of hot water and bisulphid of carbon poured on ground infested with larvæ, and the poisoning of the beetles by arsenical sprays.

Remarks on the food habits of species of Ceutorhynchus (pp. 50–52).—Brief notes are given on the host plants of certain native and foreign species of this genus.

Additional notes on the imported cabbage webworm (*Hellula undalis*) (pp. 53–61).—The first appearance of this insect in the United States was in 1895. It is probably distributed at present throughout the Gulf region and is reported as very destructive in western Australia. In breeding cages the larvæ feed to considerable extent on shepherd's purse. The insect has been reported from a number of new localities in Georgia and Alabama, and notes are given on its injuriousness during the year 1899. It was reported as feeding to some extent on the common garden purslane. Adult moths develop from the larvæ of the first generation by July 22. The egg period was found to be 3 days, the larval period 18 days, and the pupal period 6 days, making the entire life cycle 27 days. Three parasites were raised from the webworm: *Meteorus vulgaris*, *Temelucha macer*, and *Exorista pyste*. The remedies suggested are the planting of an excess of seed with a view to destroying the injured part of the crop later and growing cruciferous trap crops to be freely sprayed with Paris green.

The common rhubarb curculio (*Lixus concavus*) (pp. 61–69).—A seri-

ous outbreak of this beetle on rhubarb occurred in May, 1899, in Tennallytown, D. C. The distribution of this species includes the greater portion of the United States east of the Mississippi Valley. The more common native food plants are a species of dock and *Helianthus grosseserratus*. The beetle hibernates in the adult stage in the District of Columbia. The eggs are deposited singly in small cavities constructed in the stems of food plants. The egg period is found to be about 8 days and the larval stage about 2 months. Eggs deposited in rhubarb apparently do not develop. The remedies to be applied against this species are hand picking of the beetles and destruction of the native food plants after the deposition of the eggs.

The strawberry flea-beetle (*Haltica ignita*) (pp. 70–78).—This species is native to America and is distributed throughout the United States. Near Washington the beetles appear in May. The duration of the egg stage was found to be about 6 days; that of the larval stage, 11 days. There are apparently 2 generations annually in the vicinity of Washington. No insect enemies of this species have been discovered. The remedies suggested are spraying with arsenicals, either Paris green or arsenate of lead, both upon the cultivated and wild-food plants.

The fall army worm in 1899 (*Laphygma frugiperda*) (pp. 78–85).—This insect was unusually injurious during 1899. It was reported as attacking *Agrostis stolonifera*, *Euchena mexicana*, clover, grass, wheat, and a great variety of cultivated crops. A brief account is given of its distribution, life history, and habits, together with a short description of the species in its different stages. The observed natural enemies are the English sparrow, flicker, and *Winthemia quadripunctulata*. It is suggested that lawns might be freed from the caterpillars by the use of kerosene emulsion. Other remedies suggested are the use of poisoned baits, spraying trap crops with arsenicals, and the destruction of the volunteer grain and wild grasses.

The strawberry crown moth (*Sesia rutilans*) (pp. 85–90). This insect has caused considerable damage to the strawberry, blackberry, and raspberry in California. A brief description of it is given. The most successful remedy appears to be the submerging of affected fields. Ordinary insecticide applications seem to be useless.

The black gooseberry borer (*Xylocrius agassizii*) (pp. 90–92). This insect was reported by Fletcher as having been introduced into British Columbia from Oregon and as being injurious to gooseberry bushes. A serious infestation by it was found in an Oregon nursery. The species had previously been considered rare. The only remedy suggested is the cutting out and destruction of the injured plants as soon as infestation is discovered.

Some insect pests of Salt River Valley and the remedies for them, T. D. A. COCKERELL (*Arizona Sta. Bul. 32, pp. 269–295*).—The author reports that Salt River Valley is comparatively free from insect

pests, no scales being found on either olive or orange trees. It is suggested that the isolation of the valley from other cultivated areas and the burning effects of the sun constitute the main reasons for this immunity. The author recommends strict quarantine measures regulating the importation of fruit and ornamental trees. A number of native scales were found in this region, but they do not seem to be especially injurious, and it is thought that this condition is brought about by the natural enemies of scale insects. Notes are given on a number of the more important insects of Salt River Valley, among which may be mentioned *Pycnoderes quadrimaculatus*, San Jose scale, *Colias eurytheme*, the corn worm, *Drosophila ampelophila*, the pear-leaf blister mite, and the Bryobia mite. Approved remedies are suggested in connection with a discussion of each insect pest.

Report of the entomologist, J. B. Smith (*New Jersey Stas. Rpt. 1899, pp. 421–512, figs. 44*).—Brief notes are given on a large number of injurious insects affecting various garden and field crops, among which may be mentioned the pea-plant louse, the peach thrips, codling moth, pear slug, peach-twig borer, woolly aphis, San Jose scale, Hessian fly, fall army worm, bagworms, and the tulip soft scale. The author discusses various insecticides, among which may be mentioned arsenate of lead, Green Arsenoid, potash soap, kerosene, crude petroleum, and whale-oil soap. The experimental orchard has been increased in size. Experiments made there with various insecticides, especially against the San Jose scale, are reported. General recommendations are given regarding the time and method of making various insecticide applications to different plants. It is urged that spraying should not be done except for specific reasons. A single Vermorel nozzle or a group of 3 such nozzles is recommended as the best for general purposes.

Observations have been continued on the San Jose scale. This was not affected by the unusually low temperature which occurred during the preceding winter. Unusually large swarms of larvæ appeared about June 15 and lasted for somewhat more than 10 days. The second brood appeared late in July, the third during the middle of September, and the fourth late in October. This insect is now reported from every county in the State. Kerosene was used for the most part on apple and pear trees and less frequently on peach trees with only rare cases of injury to the trees. Further experiments were made with crude oil, in an orchard of dwarf Duchess pears and apples. A portion of the orchard had been sprayed in March with a 30 per cent mixture of crude petroleum and water, but this application had been irregular and unsatisfactory. It had been intended to treat the dwarf Duchess pears with a 15 per cent mechanical mixture of crude petroleum and water. Preliminary tests, however, indi-

cated this to be an unsafe combination, and kerosene was substituted for the crude oil on the majority of the trees. Spraying was begun June 15. A detailed account of experiments in this orchard is given from which, in connection with other work done by the author, the following conclusions may be drawn:

"In the treatment of San Jose scale it was found that kerosene is a very efficient remedy, but when carelessly used it will injure trees. Whale-oil soap will also injure fruit buds if applied early in the winter at a greater strength than 1 lb. to the gallon of water. Crude petroleum was tried on all common orchard fruits except the cherry without in any instance causing injury. This substance is recommended as having the following advantages: Great penetrating power, lasting effect, and causing a slight temporary change in the color of the bark which enables one to see at once whether or not the application has been thorough. For work on the larvæ of the San Jose scale at a time when the leaves are in foliage, kerosene or crude petroleum in a 10 per cent mechanical mixture with water is effective, but crude oil is not to be recommended for this purpose on account of its bad effect on the foliage."

Among the natural enemies of the San Jose scale the author mentions *Exochomus tripustulatus* and *Pentilia misella*.

Report of acting field director [of Gypsy Moth Commission], A. H. KIRKLAND (*Massachusetts State Bd. Agr. Rpt. 1899, pp. 356–383, pls. 3*).—In January part of the force was utilized in cutting over infested woodlands and in February and March considerable cutting and burning was done in various towns. During the year 2,300,000 trees were banded with burlap. In June 20 gangs of men operated with spraying outfits. The spraying was especially effective, since the season was unusually clear and dry. The inspection of burlaps was carried on during July and part of August. During the autumn months considerable attention was given to burning brush and the destruction of eggs.

As a result of sending circulars concerning the gypsy moth outside of the known limit of infestation, 2 new colonies were found—one at Newton and the other at Georgetown. Gangs of workers were at once dispatched to these 2 new centers of infestation and stringent measures were taken to exterminate the moth in these localities. Detailed notes are given on the progress of the work in the various infested towns. The general condition is said to be better and more encouraging than ever before.

Birds as destroyers of hairy caterpillars, E. H. FORBUSH (*Massachusetts State Bd. Agr. Rpt. 1899, pp. 316–337*).—The present article is limited to observations on birds which feed upon the gypsy moth, the brown-tail moth, the tent caterpillar, and the forest tent caterpillar. A number of places were selected where serious outbreaks of one or more of these insects had occurred and observers were stationed there to record the frequency of the visits of different birds to infested trees and, when possible, the number of insects eaten by these bird visitors.

The following birds were observed carrying hairy caterpillars to their young: Black-and-white warbler, blue jay, scarlet tanager, wood thrush, chickadee, yellow-throated vireo, red-eyed vireo, crow, catbird, black-billed cuckoo, yellow-billed cuckoo, yellow warbler, and chestnut-sided warbler. A pair of red-eyed vireos made 125 visits in 10 hours and a pair of rose-breasted grosbeaks made 426 visits in 11 hours to secure caterpillars for their young. The birds which are most concerned in the destruction of hairy caterpillars belong to the following families: Cuckoos, woodpeckers, flycatchers, crows, orioles, sparrows, tanagers, vireos, warblers, mocking thrushes, wrens, titmice, and thrushes. The author gives a list of 47 birds which feed on these caterpillars. Many birds prefer smooth caterpillars when they can be had. A new colony of gypsy moths discovered in Georgetown, Mass., was seen to be visited by large numbers of several species of birds, and it is believed that the injuries from the gypsy moth were considerably reduced by the help of these birds.

Bee wintering, A. GALE (*Agr. Gaz. New South Wales, 11 (1900), No. 8, pp. 635–638, pl. 1*).—The author states that in the Australian Colonies bees are exposed to greater dangers in the warm months than in the cold months. It is recommended, therefore, that beehives and houses be constructed especially for the purpose of properly protecting bees during the hot season. The same mechanical devices which prevent the absorption of heat also prevent the radiation of heat.

The pollination of fruit by honey-bees, W. R. LAZENBY (*Proc. Soc. Prom. Agr. Sci. 1899, pp. 68–73*).—This is essentially the same as an article previously published by the author (E. S. R., 11, p. 956).

Protective powers of insects against cold, H. ROEDEL (*Helios, 17 (1900), pp. 69–78*).—A discussion of recent literature on this subject, especially that of the extensive investigations of Bachmetjew.

Entomological notes on specimens received during 1899, W. W. FROGGATT (*Agr. Gaz. New South Wales, 11 (1900), No. 8, pp. 639–651, pls. 2*).—In this article the author gives economic and biological notes on the following insects: Ambrosia beetle (*Xyleborus solidus*); *Tenebrio molitor; Ethemaia sellata,* injurious to garden crops in the caterpillar stage; *Prosayleus comosus*, attacking the foliage of fruit trees; *Desiantha caudata*, also injurious to fruit trees; *Paramorpha aquilina*, injurious to oranges; *Nola metallopa*, feeding upon the foliage of eucalyptus; *Nerius lineolatus*, injurious to the banana; Cattleya fly (*Cecidomyia* sp.); and *Pochazia australis.*

Notes on insects of the year 1899, F. L. HARVEY (*Maine Sta. Bul. 61, pp. 31–42, figs. 2*).—This bulletin contains brief notes on the chinch bug, elm plant louse, forest tent caterpillar, Buffalo carpet beetle, etc. The brown-tail moth (*Euproctis chrysorrhœa*) is reported as occurring in South Berwick and Kittery Point. At the latter locality the insect is supposed to have been introduced two years before on household goods shipped from Cambridge, Mass.

Insects of New Jersey, J. B. SMITH (*New Jersey State Bd. Agr. Rpt. 1899, pp. 755, figs. 328*).—A popular account is given of the life history, habits, and classification of insects in general, the injury caused by insects, and methods of preventing such damage. The greater part of the article is occupied with a catalogue of the insects found to occur in New Jersey with a brief characterization of the different orders and families, and notes on the more important injurious species.

New insect pests of the year 1899, W. LOCHHEAD (*Ontario Agr. Col. and Expt. Farm Rpt. 1899, pp. 34–37, figs. 4*).—Brief notes on the asparagus beetles (*Crioceris asparagi* and *C. 12-punctata*), *Plutella cruciferarum*, the pea louse, and the corn aphis.

Recent additions to the list of injurious insects of Canada, J. FLETCHER (*Trans. Roy. Soc. Canada, 2. ser., 5 (1899–1900), Sec. IV, pp. 207–231, figs. 18*).—The author presents observations on the habits and economic importance of a number of injurious insects, among which the following may be mentioned: American frit fly, wheat-stem sawfly, *Hadena arctica*, *Aphis rumicis*, *A. brassicæ*, *Psila rosæ*, *Noctua fennica*, *Eriopeltis festucæ*, San Jose scale, *Magdalis æneseens*, *Anthonomus signatus*, apple maggot, clover mite, and *Psylla piricola*.

Notes on the geographical distribution of injurious Hemiptera, H. OSBORN (*Proc. Soc. Prom. Agr. Sci. 1899, pp. 59–62*).—This article contains a brief outline of the distribution of the various families of this order of insects.

The Hessian fly, G. MCCARTHY (*Bul. North Carolina State Bd. Agr., 21 (1900), No. 6, pp. 14–16*).—Popular notes on the life history and habits of this insect, together with brief descriptions of the most approved way of controlling it.

The diseases and insects affecting apple trees in North Carolina, with suggestions for their destruction, G. MCCARTHY (*Bul. North Carolina State Bd. Agr., 21 (1900), No. 7, pp. 28–39, figs. 18*).—Brief notes on insecticides, fungicides, and the spraying machinery necessary in the treatment of apple diseases.

Report on the brown-tail moth, E. W. WOOD ET AL. (*Massachusetts State Bd. Agr. Rpt. 1899, pp. 384, 385, pl. 1*).—It is stated that the area of infestation of this insect is rapidly increasing and that no colony has been exterminated since the insect became well established.

Report of acting field director, A. H. KIRKLAND (*Massachusetts State Bd. Agr. Rpt. 1899, pp. 386–388*).—The sum of $10,000 was expended during 1899 in the destruction of the brown-tail moth. In April many webs were destroyed in the worst infested localities; spraying with arsenate of lead was carried out in June with good success. During November the majority of the webs in Medford, Malden, and Everett were destroyed.

The area of infestation by the brown-tail moth in the fall of 1896 was about 29 square miles. By the fall of 1899 this area had increased to 928 square miles. It is stated that the insect will probably become distributed in the near future over the whole State.

The gypsy moth in the legislature, M. A. MORSE (*Massachusetts State Bd. Agr. Rpt. 1899, pp. 37–43*).—This is a brief statement of the investigation of the gypsy moth question before the legislative committee on this subject.

Report of the committee on the gypsy moth, insects, and birds, E. W. WOOD ET AL. (*Massachusetts State Bd. Agr. Rpt. 1899, pp. 341–351, pls. 2*).—The committee presents a report of expenditures made and work performed during the year 1899. The work of the gypsy moth commission was carried out along lines similar to those adopted in previous years.

The committee recommends an attempt to secure the cooperation and aid of the National Government in exterminating the gypsy moth. It is maintained that although the work against the gypsy moth has been somewhat handicapped by insufficient and delayed appropriations that constant progress is being made toward the desired end.

Report of the entomologist, C. H. FERNALD (*Massachusetts State Bd. Agr. Rpt. 1899, pp. 352–355, pl. 1*).—The author states that "there is no longer any question in the minds of those who have made a careful personal investigation of the work throughout the infested territory that the gypsy moth can be exterminated." An estimate is made of the amount of money which will be required in future years for the complete extermination of the insect.

The elm-leaf beetle in Massachusetts, A. H. KIRKLAND (*Massachusetts State Bd. Agr. Rpt. 1899, pp. 289–300, figs. 4*).—Notes on the habits, life history, food plants, natural enemies, and remedies for this insect.

The extermination of the enemies of coffee, G. D'UTRA (*Bol. Inst. Agr. São Paulo, 10 (1899), No. 11-12, pp. 778-785*).—The author discusses the appearance, life history, and habits of *Dactylopius destructor* and gives brief notes on other related scale insects. Tables are given showing the amount of cyanid of potash, sulphuric acid, and water to be used in giving the fumigation treatment to infested trees of different sizes. Formulas are given for other insecticides to be used against scale insects, the insecticides containing sulphate of copper, essence of terebinth, kerosene, and water.

Coccidæ of Kansas, III, S. J. HUNTER (*Kansas Univ. Quart., 9 (1900), No. 2, pp. 101-107, pl. 1*).—Brief descriptive and biological notes on species of Chionaspis and Pulvinaria.

Remarks on Indian scale insects, with descriptions of new species, E. E. GREEN (*Indian Mus. Notes, 5 (1900), No. 1, pp. 1-13, pls. 2*). Descriptive and biological notes are given on species of Aspidiotus, Fiorinia, Chionaspis, Lecanium, Pulvinaria, Ceroplastes, Eriochiton, and other genera. A number of species are described as new, and notes are given on their economic importance and life history. Among the new species mention may be made of *Chionaspis separata*, which occurs on tea leaves; *Lecanium watti*, occurring on the twigs and stems of the tea plant; and *Eriochiton theæ*, which is found upon the branches and twigs of the tea plant.

Harpalus caliginosus as a strawberry pest, with notes on other phytophagous Carabidæ, F. M. WEBSTER (*Canad. Ent., 32 (1900), No. 9, pp. 265-271, pl. 1*).—In several localities in Ohio this beetle was found to attack strawberries, injuring or destroying in some cases a large percentage of the crop. The damage was done during the night and the beetles seemed to prefer the seeds, although in securing the seeds the pulp was necessarily rendered unmarketable. Brief notes are presented on the literature concerning similar habits of related species.

Recent experiments in the destruction of phylloxera upon grapevines, G. COUANON ET AL. (*Bul. Min. Agr. [France], 19 (1900), No. 1, pp. 135, 136*).—A number of experiments were tried by the authors in ridding grapevine plants of the phylloxera. Plants were immersed in hot water for 5, 4, and 3 minutes for different lots. The water in each case had a temperature of 53° C. at the beginning and 51° at the end of the immersion. The plants were not injured in any case by the immersion in hot water and the phylloxera were killed in both the adult and egg stages.

Fumigation for insect pests, W. E. BEAR (*Jour. Roy. Agr. Soc. England, 3. ser., 11 (1900), pt. 11, pp. 263-291, figs. 3*).—This article contains a descriptive and historical account of fumigation with hydrocyanic-acid gas, bisulphid of carbon, and tobacco, as practiced in the United States, Cape Colony, New Zealand, Victoria, New South Wales, South Australia, France, Belgium, and England.

Nursery fumigation and the construction and management of the fumigating house, W. G. JOHNSON (*Pennsylvania Dept. Agr. Bul. 56, pp. 24, figs. 7; Rpt. 1899, pp. 606-621, figs. 7*).—The bulletin contains a general account of the history of fumigation for the destruction of insects, the necessary equipment for this operation, the construction of the fumigating house, preparation of trees for fumigation, the method of generating the gas, and the effect of gas upon various kinds of nursery stock.

Cyaniding tents, A. H. BENSON (*Queensland Agr. Jour., 7 (1900), No. 1, pp. 39-41, pl. 1*).—The materials and methods of making tents for cyaniding fruit trees.

Spraying crops for profit, S. T. MAYNARD (*Massachusetts State Bd. Agr. Rpt. 1899, pp. 261-272, pls. 4, figs. 6*).—This is a popular statement of methods and remedies to be applied in the treatment of the insect pests of various economic plants.

Crude petroleum as an insecticide, J. B. SMITH (*Proc. Soc. Prom. Agr. Sci. 1899, pp. 63-67*).—The essential facts of this article have been previously noted from another publication (E. S. R., 11, pp. 760-762).

Nematodes and ammonia salts, C. SCHREIBER (*Rev. Gén. Agron. Louvain, 9*

(*1900, No. 3, pp. 97-102*).—It was found upon experiment that both chlorid and nitrate of ammonia are efficient agents in the destruction of nematodes. The rapid diffusion of nitrate of ammonia renders its effect less durable. In a dry condition it was much more effective than ammonia in a gaseous form.

FOODS—ANIMAL PRODUCTION.

Commercial beef extracts, T. Macfarlane and A. McGill (*Lab. Inland Rev. Dept., Canada Bul. 62, pp. 22*).—The composition of a considerable number of beef extracts and similar products is reported. Methods of analysis are described and discussed at some length, and also the food value of these materials.

"It is evident that the flesh bases can not be called food stuff in the proper sense of that term. They represent a stage of the process by which complex nitrogen compounds are changed to simple ones, supplying the energy so set free to the animal organism in the form of vital force. They may still have some food value, since they are not excreted as such, but undergo further simplification, till they appear as urea. It is certain that their food value (if any) is very much less than that of proteids proper. When once the urea stage is reached, the urea must be promptly got rid of. A form of blood poisoning known as uræmia results when any obstruction to the elimination of urea occurs. . . .

"Apart from any possible nutritive value which they have, these flesh bases undoubtedly possess a stimulant action on the system, analogous to that exhibited by the alkaloids of tea, coffee, cocoa, etc., and it is beyond question that to this stimulating effect, rather than to any nutritive power, they owe their medical value.

"If, however, the beef tissues have been peptonized before extraction by water, the peptone formed will be taken into solution, along with the flesh bases, and the extract so formed will possess a true food value. Some manufacturers claim to peptonize the material from which they prepare their extract. This peptonization is not usually effected by means of pepsin, which would be too costly, but by acids, mineral or organic, or by vegetable ferments, such as that present in pineapple juice.

"Another way of introducing into the article true proteid material is to add finely ground 'beef meal' to the extract proper. Of course, such proteid matter is insoluble, and requires to be digested in the stomach before it becomes available for the repair of tissue waste. It does not properly form a part of the real extract, but has been added to this, in order to furnish a food value, which the true extract is known not to possess. No special value can be claimed for the ground beef so added over an equivalent weight of ordinary lean beef, except such as may accure from the fact of its being in very fine powder, and thus more easily acted on by the digestive fluids of the stomach."

Composition and digestibility of corn fodder and corn stover, C. G. Hopkins (*Illinois Sta. Bul. 58, pp. 361-370*).—Continuing previous work (E. S. R., 8, p. 509), the digestibility of corn fodder and corn-and-cob meal was tested with 4 lots of 2-year-old steers, each lot containing 4 animals. In general the methods previously described were followed. To secure more uniform material for feeding and for analysis, the ears were separated from the stover, the stover was run through a cutting machine, and the corn and cobs were ground. The experiments covered 10 days, the results being reported for the first 4 days, the last 6 days, and for the whole period, to permit a study of

the effect of the length of period on digestibility. The average results follow:

Coefficients of digestibility of corn fodder and corn stover.

	Dry matter.	Protein.	Fat.	Carbohydrates.	Crude fiber.	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Corn fodder = ground corn and cobs and shredded stover, fed 4 days	68.3	43.3	68.2	74.8	68.7	23.9
Corn fodder, fed 6 days	67.0	43.3	64.0	73.5	67.0	23.1
Corn fodder, fed 10 days	67.5	43.3	65.7	74.0	67.7	23.4
Shredded corn stover, fed 4 days	58.1	37.8	58.9	60.5	69.9	23.0
Shredded corn stover, fed 6 days	58.3	37.1	52.6	60.7	70.5	22.2
Shredded corn stover, fed 10 days	58.2	37.4	55.2	60.6	70.3	22.5

The author's conclusions follow:

"When the ears are ground to corn-and-cob meal, corn fodder shows a higher percentage of digestibility than any other common coarse food stuff, the digestibility of the dry matter being 8 per cent higher than timothy hay and 14 per cent higher than clover hay. The total digestibility of corn fodder is increased 6 per cent by grinding the ears to corn-and-cob meal previous to feeding, while the value of the ears alone is increased nearly 20 per cent by grinding. In both its composition and digestibility corn stover closely resembles timothy hay, and the edible portion of the stover has a nutritive value fully equal to that of timothy."

Bullock feeding experiments in Norfolk, T. B. WOOD (*Jour. Bd. Agr. [London], 6 (1899), No. 3, pp. 311-332*). In the first test reported, which was made in 1895–96, with 20 3-year-old Irish steers divided into 4 uniform lots of 5 each, the special object was to determine the amount of roots which could be profitably fed. After a preliminary period of about a month, the test proper began, November 28, 1895, and continued 77 days. All the steers were fed 10 lbs. per head of a grain ration made up of equal parts of linseed meal, cotton-seed meal, crushed wheat, and crushed barley. Hay and chaffed straw were fed *ad libitum*, and the following amounts of Swedish turnips: Lot 1 42 lbs. per head daily, lot 2 84 lbs., lot 3 126 lbs. (only 107 lbs. being consumed, on an average), and lot 4 all they would eat, averaging 115 lbs. per head.

The steers weighed on an average 1,254 lbs. at the beginning of the test. The average daily gains for the 4 lots were 1.8, 2, 2, and 2.2 lbs. per head, respectively. It was calculated that lot 1 converted 6.9 per cent of the dry matter consumed into beef; lot 2, 7.5 per cent; lot 3, 7.1 per cent, and lot 4, 7.6 per cent. At current prices for feeding stuffs, the profits on the 4 lots are calculated at \$15.35, \$18.23, \$15.13, and \$17.63, respectively. "The Norfolk practice of giving bullocks all the roots they will eat appears, therefore, to be an economical one, as it leads to a larger consumption of dry matter, a high percentage of which is converted into beef."

The comparative value of different commercial feeding stuffs was tested in 1896–97, 1897–98, 1898–99. The first of these tests was begun with 4 lots of 5 Irish steers, but one animal in each lot was dropped

on account of illness. The other two tests were each made with 4 lots of 5 each, Irish steers being used in 1897–98 and red polled Norfolks in 1898–99. The lots in every case were numbered from 1 to 4 consecutively. Each year lot 1 was fed linseed cake alone and lot 2 a mixture of equal parts of linseed cake and ordinary cotton-seed cake. Lot 3 was fed decorticated cotton-seed cake and maize meal (1:1) in 1896–97; in the other 2 tests dried brewers' grains was substituted for maize meal. Lot 4 was fed a mixture which through the greater part of the first test consisted of linseed cake, cotton-seed cake, maize meal, and dried grains. In the latter part of the test the dried grains was omitted. In the second test the grain mixture consisted of equal parts of linseed cake, cotton-seed cake, and maize meal; and throughout the greater part of the third test, of linseed cake and cotton-seed cake (1:1:1:1), linseed cake being used alone in the latter part of the test. The average daily gain made in the 3 years by the lots numbered 1 was 1.94 lbs.; by those numbered 2, 1.68 lbs.; and by those numbered 3, 1.61 lbs., the gain per hundred pounds of dry matter consumed being 7.04, 6.08, 5.8 lbs., respectively. The average daily gains made by the lots numbered 4 in the 3 years were 1.91, 1.53, and 1.41 lbs., respectively. "From the point of view, therefore, of the absolute increase produced by the feeding, linseed cake alone, as an addition to the usual Norfolk diet of chaff and roots, has shown in each of 3 years a decided advantage over each of the mixtures which have been tried."

A discussion of financial returns of the experiment, however, in the author's opinion, showed that at present prices a mixture of decorticated cotton-seed cake and some less expensive material, such as dried grains or maize meal, is more economical than linseed cake alone. "We must therefore add to the general conclusions that while linseed cake alone, and decorticated cotton-seed cake as part of a mixture, have given good results when fed to bullocks, the use of common cotton-seed cake has been throughout the experiment most unprofitable."

The live and dressed weight of the steers is recorded and the ratio of the latter to the former, the average of the 3 years for the lots numbered 1 being 59.1 per cent; the lots numbered 2, 57.99 per cent; the lots numbered 3, 58.69 per cent; and the lots numbered 4, 59.46 per cent. "[The steers fed linseed cake], which have made the greatest increase in weight, also give the highest proportion of carcass weight, while those which received common cotton cake are lowest both in rate of increase and percentage of carcass weight, the decorticated cotton cake lot coming midway in both cases."

Heavy, medium, and light meal rations for fattening steers, G. E. DAY (*Ontario Agr. Col. and Expt. Farm Rpt. 1899, pp. 75, 76*).—In continuation of previous work (E. S. R., 11, p. 664), 3 lots of 3 steers each were fed for 168 days, beginning December 6, on different amounts of corn and oats, equal parts. The aim was to feed lot 1 a

pound of this mixture; lot 2, ⅔ lb., and lot 3, ⅓ lb. per 100 lbs. live weight at the start, and to increase this as rapidly as was deemed advisable. Lot 1 would not eat all the desired quantity, but was kept as near the limit as was deemed safe. All the lots were fed hay and pulped roots in addition to the grain.

The average daily gain of the 3 lots was 1.77, 1.74, and 1.62 lbs., respectively, the corresponding cost of food per pound of gain being 7.68, 7.22, and 7.21 cts. These results and those of previous tests are briefly discussed.

Feeding experiments with steers to compare Liebig's meat meal and cotton-seed meal, F. ALBERT (*Landw. Jahrb., 28 (1899), No. 5–6, pp. 963–972*). The comparative value of meat meal and cotton-seed meal was tested with 2 lots of 7 steers each at the Lauchstädt Experiment Station. Lot 1 was fed, per 1,000 kg. live weight, 50 kg. of ensiled beet leaves, 2 kg. of meadow hay, 12 kg. of straw and chaff, 4 kg. of palm-cake molasses, 2 kg. of meat meal, and 7.59 kg. of ground corn. This furnished 3 kg. of digestible protein and 17 kg. of digestible nitrogen-free material. Lot 2 was fed the same ration except that 3.772 kg. of cotton-seed meal was substituted for the meat meal, and the ground corn was diminished to 5.899 kg. This furnished the same amount of digestible protein and nitrogen-free material as the ration fed lot 1.

During the test the amount of ensiled beet leaves was diminished to 30 kg., and 20 kg. of beet chips was added to the ration of each lot, more meadow hay and some alfalfa hay being fed also.

During the 154 days of the test, lot 1 made a total gain of 1,064 kg.; lot 2, 1,029 kg. The steers were slaughtered and judged by an expert. The conclusion was drawn that the meat meal used was a suitable feeding stuff and without bad effects on the condition of the steers or the dressed carcasses. The author also reports some figures regarding the loss which steers suffer in transportation and the length of time required to make good such losses.

Experiments in sheep feeding, G. E. DAY (*Ontario Agr. Col. and Expt. Farm Rpt. 1899, pp. 82, 83*). Continuing previous work (E. S. R., 11, p. 666), a test of 42 days' duration is reported of the value of first and second cuttings of alfalfa and red clover for lambs.

"Everything considered, it can not be said that either of the fodders showed marked superiority over the other. The experiments indicate that the feeding values of red clover and alfalfa hay are very similar. All animals continued in perfect health from the beginning to the end of each experiment, indicating that alfalfa hay is a safe fodder for sheep, if it is cut and cured at the right stage of growth, say in early bloom."

A test is also briefly reported in which corn and peas were compared as food for fattening lambs. Three equal lots were used. Lot 1 was fed ground corn; lot 2, ground peas; and lot 3, a mixture of equal

parts of these grains. In every case a pound of meal per lamb was fed at the beginning of the test, the amount being increased until it reached 1½ lbs. The test covered 104 days. The average weekly gain of the lambs in lot 1 was 2.52 lbs., 3.8 lbs. of meal being consumed per pound of gain. The lambs in lot 2 made an average weekly gain of 2.91 lbs., 3.3 lbs. of meal being consumed per pound of gain. The average weekly gain of the lambs in lot 3 was 2.6 lbs., the meal consumed per pound of gain being 3.68 lbs. "According to the results of the second trial, if pea meal is valued at $20 per ton, ground corn would be worth $17.35 per ton."

Sugar-beet pulp for sheep, H. C. PRICE (*Breeders' Gaz., 36 (1899), pp. 844, 855; Agr. Student, 6 (1900), No. 6, pp. 111–113*). A comparison of sugar-beet pulp with other feeding stuffs for sheep is briefly reported. The work was carried on at Cornell University. Four lots of 10 sheep each were used. Lot 1 was fed clover hay, lot 2 corn silage, lot 3 oat straw, and lot 4 sugar-beet pulp, enough grain being given in each case to make the nutritive ratio of the different rations the same. The conclusions reached follow:

"Sugar-beet pulp may be successfully fed to fatten sheep at the rate of 12 to 15 lbs. a day per head. At $1 per ton it is a cheaper food for fattening sheep than corn silage at $3 or clover hay at $8 per ton. It can not become a stock food of importance outside of a radius of a few miles from the sugar-beet factory until some means is invented for expressing the water out of it. The best results can be obtained in fattening sheep on sugar-beet pulp and corn silage when some hay is fed with them."

Experiments with pure-bred swine, G. E. DAY (*Ontario Agr. Col. and Expt. Farm Rpt. 1899, pp. 77–79, figs. 7*).—Continuing previous work (E. S. R., 11, p. 668), corn and barley were compared on 6 lots of pure-bred swine. The test is briefly reported. The food required per pound of gain in the different lots was as follows: Berkshire, 3.18 lbs.; Tamworth, 3.31 lbs.; Yorkshire, 3.35 lbs.; Chester White, 3.37 lbs.; Duroc Jersey, 3.37 lbs.; Poland China, 3.50 lbs. At the close of the test the pigs were slaughtered.

"In each of 4 experiments the Yorkshires and Tamworths were pronounced by the packers more suitable for the export bacon trade than the representatives of other breeds. Generally speaking, the results of 4 experiments indicate that economy of production is more dependent upon the individuality of animals than upon their breed. The experiments indicate that it does not necessarily cost more to produce a pound of gain upon a hog of suitable bacon type than upon a hog of undesirable bacon type."

Experiments with grade swine, G. E. DAY (*Ontario Agr. Col. and Expt. Farm Rpt. 1899, pp. 80–82*).—The value of different rations, as shown by the gains made and firmness of bacon produced, was tested with 4 lots of grade pigs, weighing about 60 lbs. each. Corn, peas, and barley were each fed alone and with middlings. The experiment lasted from July 28 to October 10, and included 49 pigs. At the close

of the test the pigs were slaughtered and judged by an expert. The author's conclusions follow:

"Exclusive corn feeding during a somewhat extended period gave very unsatisfactory results in point of gain, and produced bacon of extremely soft, undesirable character. The exclusive feeding of pea meal resulted in unthrifty animals and poor gains; but a mixture of 3 parts pea meal and 1 part middlings by weight gave good gains and produced bacon of excellent quality. An exclusive ration of barley gave satisfactory gains and produced exceptionally firm bacon. A two-thirds ration of barley with all the rape the hogs would eat, followed by about 3 weeks' exclusive barley feeding at the close, gave economical gains on the whole and produced bacon of good quality, though scarcely so firm as that produced by barley or by peas and middlings.

"Barley appears to be an exceptionally safe and valuable food for swine, whether fed alone or in combination with other foods. Peas should always be fed in combination with other foods, in which case they give good results. Exclusive corn feeding is no doubt risky under any conditions, but the practice can not be too strongly condemned when followed for any considerable length of time."

Fattening hogs with drought-resisting crops, H. M. COTTRELL and J. G. HANEY (*Kansas Sta. Bul. 95, pp. 69-95, figs. 10*).—Eight series of feeding experiments with pigs are reported on the value of crops which resist drought and are adapted to the Kansas uplands. These include Kaffir corn, soy beans, and alfalfa. Corn meal, cottonseed meal, and skim milk were fed in addition in some of the tests. Pure-bred Berkshire and Poland China pigs were used in the first 3 series, and in the remainder, cross-bred pigs, mostly Berkshire-Poland Chinas of average quality. Series 1 to 6 were made in the winter, series 7 in the spring, and series 8 in the fall and winter. Care was taken in each case to insure uniform lots. In the second series the pigs were fed in closed sheds. In the other series they were fed in the winter in sheds open to the south and in the summer had access to low sheds without sides. All the lots were given salt, wood ashes, and charcoal. The tests which had to do with soy beans were briefly reported in a previous publication (E. S. R., 12, p. 142).

The results of the different series are given in full in tabular form and are discussed in detail. General deductions are drawn from the work as a whole. Among the more important are the following:

"[The fact that] average mixed-bred hogs require from 10 to 30 per cent more food per hundred pounds of gain than the pure-bred hogs is a strong argument for better breeding. . . . The hogs that made the best gains in these experiments were well boned, with both fore and hind quarters well developed, rather rangy, well developed through the heart, with heavy-boned legs of fair length. The average amount of feed required to produce 1 lb. of gain was 5.28 lbs. of grain, with variations in feed ranging from 3.69 to 7.49 lbs. of grain. It is noticeable that the hogs requiring the least amount of feed per pound of gain had soy-bean meal in their rations. The 6 lots of hogs having soy beans as part of their ration required an average of 4.11 lbs. of grain per pound of gain, while the 19 lots not fed soy beans required an average of 5.64 lbs. of feed per pound of gain, an increase in food required of over 37 per cent. The moral of this is, raise and feed soy beans. Skim milk and alfalfa hay also greatly reduced the amount of grain required per pound of gain.

"Grinding Kafir corn gave greatest returns in our first experiment, showing a saving of 13 per cent in amount of feed required per pound of gain. In all other trials Kafir corn meal gave less gains than the whole grain, the loss from grinding being 9 and 14 per cent in the different trials.

"Soaking the Kafir corn resulted in losses of 7 and 17 per cent. Wetting the grain at the time of feeding gave best results, and this is the method we recommend. We put the whole grain dry into the trough and pour over it sufficient water or skim milk to thoroughly wet the grain. When water is used we add enough to have a little left in the trough after the grain is eaten. Kafir corn is dusty, and when fed dry makes hogs cough. Grinding alfalfa hay resulted in a loss, and we recommend the hay to be fed whole, just as to cattle. Grinding the soy beans caused a loss of 11 per cent in the one experiment where both ground and whole beans were fed.

"These experiments show that Kafir corn and either soy beans or alfalfa, properly combined, produce good results in fattening hogs. On an upland farm an acre of Kafir corn will produce more pork than an acre of corn. Kafir corn fed alone to hogs does not give nearly so large gains as when fed with soy beans or alfalfa hay. Kafir corn combined with either soy beans or alfalfa hay will produce more pounds of pork per acre from upland than are usually produced from adjoining bottom lands from corn. Kafir corn, or its near relatives, rice corn and Jerusalem corn, yield well in every part of the State. The experiments reported in this bulletin show that, by combining soy beans or alfalfa hay with Kafir corn, hogs may be fattened profitably on every farm in the State. Corn should be raised where it will yield more than Kafir corn, and Kafir corn where its yield is the higher. . . .

"The yields we have obtained from Kafir corn, soy beans, and alfalfa hay, the showing of only one crop failure in 11 years, and the good results obtained from fattening hogs with combinations of these feeds show a greater certainty of crop and more pounds of pork per acre than are usually secured by ordinary feeds in other States."

Report of the manager of the poultry department, W. R. GRAHAM (*Ontario Agr. Col. and Expt. Farm Rpt. 1899, pp. 130–134, fig. 1*).—Brief statements are made on the work of the poultry department during the past year. The points touched on are summer layers, early winter layers, feeding, artificial incubation, artificial *v.* natural incubation, egg preservation, raising ducks, fattening chickens, and cramming machine.

The different methods of preserving eggs tested were (1) immersion in solutions of water-glass of different strengths, (2) in lime solution, (3) coating with vaseline, (4) packing in common salt, (5) packing in dry oats, and (6) immersing in water-glass and packing in an egg case after drying. The author did not obtain as favorable results with solutions of water-glass as other investigators have. The eggs preserved in limewater had a slight taste of lime. Those coated with vaseline kept well, but absorbed a very undesirable flavor of the vaseline. Only a small percentage of the eggs packed in salt were bad, but all had suffered a good deal from evaporation. The eggs packed in oats were musty and had evaporated fully as much as those packed in salt. Those coated with pure water-glass were fairly well preserved, but lacked flavor.

The comparative value of skim milk and boiling water for moisten-

ing food was tested with 2 lots, containing respectively 6 and 7 Pekin ducks. Lot 1 was fed shorts, bran, and corn meal, 1:1:1, moistened with skim milk. Lot 2 was fed the same mixture, moistened with boiling water. After the first week a little animal meal was added to the ration of this lot. The lot fed skim milk made the better gain in 6 weeks. In 4 weeks following, when all had the skim-milk ration, the gains were the same for both lots. "It would appear that there is no advantage in mixing the food with boiling water."

Brief statements are made concerning the food eaten and gains made by 115 chickens fattened in coops. In 38 days the chickens consumed a total of 910 lbs. of oats, 305 lbs. of buckwheat, 900 lbs. of skim milk, and 9 lbs. of tallow, and made a total gain in weight of 216 lbs.

The possibility of influencing the color of dressed chickens by the ration fed was tested with 2 lots, each containing 3 Plymouth Rock pullets from the same hatching. Lot 1 was fed a mixture of finely ground oats and buckwheat, moistened with skim milk, and lot 2, yellow corn moistened with water. After 11 days they were killed and dressed. "Those on the oat and skim-milk ration presented a creamy-white appearance, while those fed on the yellow corn were of a deep yellow color."

What to eat and why, W. O. Atwater (*Sci. Siftings, 17 (1900), Nos. 436, p. 273; 437, p. 286; 438, pp. 300, 301; 439, p. 315; 440, p. 329; 441, p. 343; 442, pp. 356, 357; 18 (1900), Nos. 443, p. 7; 444, pp. 20, 21; 445, p. 35*).—Reprinted from Farmers' Bulletin 23 of U. S. Department of Agriculture (E. S. R., 6, p. 752).

Banana or plantain flour (*Indian Forester, 26 (1900), No. 3, pp. 90–92*).—From articles in *Belgique Coloniale* and *Revue des Cultures Coloniale*, the composition of unripe and ripe plantain is quoted, the food value of the fruit is discussed, and directions given for a number of dishes made from plantain flour. Two analyses of banana flour are also quoted. (The term banana and plantain seem to be used interchangeably.)

Tolokno, a useful food, W. F. Weljamowitsch (*Wojenno Med. Jour., 77 (1899), p. 1277; Chem. Ztg., 23 (1899), No. 29, Repert., p. 314*).—Tolokno is a food product much used in northern Russia and other parts of the Empire. It is made by soaking oats for a day in water, heating them in an oven for a day, and then drying and removing the hull.

Value of gluten in flour, R. Harcourt (*Ontario Agr. Col. and Expt. Farm Rpt. 1899, pp. 40, 41*).—The author discusses briefly the importance of gluten from the standpoint of baking quality of flour, the influence of climate and soil on the character of the wheat, etc.

Analyses of cocoa, J. Hughes (*Jour. Jamaica Agr. Soc., 4 (1900), No. 5, pp. 288–290*).—Analyses of a number of brands of cocoa are quoted from the Ceylon *Tropical Agriculturist*.

Contribution to the chemical examination of tea, A. Beythien, P. Bohrisch, and J. Deiter (*Ztschr. Untersuch. Nahr. u. Genussmtl., 3 (1900), No. 3, pp. 145–153*).—The author reports analyses of a number of sorts of tea.

Feeding stuff inspection, C. D. Woods and J. M. Bartlett (*Maine Sta. Bul. 59, pp. 22*).—The points of the Maine law regarding the sale of feeding stuffs which the authors consider of most interest to the dealer and consumer are noted, and analyses

made in accordance with the law are reported of cotton-seed meals, gluten meals and gluten feeds of different brands, calf meal, linseed-oil meal of different brands, corn-and-oat feed of different brands, corn, oats, and barley; cereal by-products, poultry feed, rice feed, poultry meal, beefs craps, meat meals, and cattle or poultry bone. The constituents reported are protein and fat. The violations of the State law are discussed.

Feeding stuffs, H. B. McDonnell (*Maryland Agr. Col. Quart., 1900, No. 8, pp. 1-14*).—Theories of nutrition and other general matters are discussed, and the State law regarding feeding stuffs quoted. A number of analyses, made in accordance with this law, are reported, including corn, oats, and barley; cereal by-products, ground rye, corn meal, ground corn-and-cob meal, corn chops, fine siftings from ground corn, and a commercial mixed feed.

Fodders and feeds, L. A. Voorhees and J. P. Street (*New Jersey Stas. Rpt. 1899, pp. 120-125*).—Analyses are reported of oats and peas, cowpeas, soy beans, velvet beans, barnyard millet, pearl millet, crimson clover, sand vetch, green rye, green barley, corn fodder, teosinte, leaming corn, red and white Kafir corn, flint corn, rural branching durra, Southern white corn, evergreen broom corn, yellow millo maize, sugar cane, alfalfa (different cuttings), Dwarf Essex rape, hay, clover hay (second crop), gluten meal, cotton-seed meal, dried brewers' grains, dairy feeds, corn feed, wheat bran, wheat bran mixed with palm oil, grain hulls, mill sweepings, and beef meal.

Miscellaneous cattle-food analyses, W. Frear (*Pennsylvania Sta. Bul. 50, pp. 7-12*).—Analyses are reported of cereal by-products, corn-oat-and-barley feed, buckwheat feed, buckwheat bran, buckwheat hulls, dried brewers' grains, cerealine feed No. 2, yellow dent corn, corn meal, ground corncobs, corn feed, adulterated cottonseed meal, gluten feed and meal—misbranded, kiln-dried feed, wheat bran, and a condimental food.

Feeding and feeding stuffs, H. J. Wheeler and A. W. Bosworth (*Rhode Island Sta. Bul. 64, pp. 103-124*).—The authors discuss feeding stuffs and feeding standards and give a brief table showing the digestible nutrients in the principal feeding stuffs. The protein and fat in a number of samples of concentrated feeding stuffs sold in Rhode Island are reported, and when such data were available, the results compared with the manufacturers' guaranty of the composition of the feeding stuffs. The materials examined include cotton-seed meal, gluten meal, barley sprouts, corn-oat-and-barley feed, hominy feeds, cereal by-products, commercial mixed feed, and provender.

Condimental stock foods, R. W. Clothier (*Industrialist, 26 (1900), No. 34, pp. 457-461*).—The composition of condimental stock food is reported and compared with other feeding stuffs. A lot of 211 sheep fed alfalfa hay and ear corn gained 117 lbs. more than a lot of 209 fed the same ration and condimental stock food in addition.

Distillery waste, W. Frear and C. A. Browne (*Pennsylvania Sta. Bul. 50, pp. 3-6*).—The authors report the composition of distillery waste obtained in the manufacture of vinegar from fermented grain. In preparing this product for market the greater part of the water is removed from the material, which is finally pressed and dried. The sample analyzed represented the drained residue before drying.

Market prices of commercial feeds, L. A. Voorhees and J. P. Street (*New Jersey Stas. Rpt. 1899, pp. 126, 127*).—The market prices for several years of a considerable number of commercial feeding stuffs are reported.

Table of nutritive equivalents of different feeding stuffs, L. Grandeau (*L'Engrais, 15 (1900), No. 3, pp. 65, 66*).—A condensation of an article previously noted (E. S. R., 12, p. 80).

Pie melons for stock feed, M. E. Jaffa (*Pacific Rural Press, 59 (1900), No. 17, p. 261*).—An analysis is reported.

Feeding value of beet tops and beet pulp (*Pacific Rural Press, 59 (1900), No. 8, pp. 117, 118*).—The comparative value of beets and other feeds is discussed.

Cattle feeding in the United States with residuum beet pulps and molasses (*Sugar Beet, 21 (1900), No. 1, pp. 8, 9*).—A brief account of the successful use of sugar beet by-products as feeding stuffs.

Use and abuse of rations, A. M. Soule (*Tennessee Sta. Rpt. 1899, pp. 31–33*).—Brief popular notes are given on this subject.

Investigations on the behavior of animal food in the human body, K. Micko, P. Müller, H. Poda, and W. Prausnitz (*Ztschr. Biol., 39 (1900), No. 2, pp. 277, 278*).—A note on a series of investigations of which the following is the first.

Concerning plasmon, a new protein preparation, H. Poda and W. Prausnitz (*Ztschr. Biol., 39 (1900), No. 2, pp. 279–312*).—A full account of experiments briefly reported elsewhere.[1] Plasmon, a preparation made from the casein of skim milk was consumed as part of a mixed diet by several men. The digestibility of the ration was determined and the balance of income and outgo of nitrogen. The principal conclusions follow: Plasmon is well assimilated. Only very small amounts are excreted in the feces. As shown by the balance of income and outgo of nitrogen, plasmon can replace meat in the diet.

Comparative studies of the feces from plasmon and meat diet, K. Micko (*Ztschr. Biol., 39 (1900), No. 3, pp. 430–450*).—Continuing the work reported above, the author studied the feces when plasmon and meat were consumed, special attention being given to determining the ratio of nitrogen to phosphorus, the xanthin-nitrogen and nuclein bodies, casein, and paranuclein.

In the author's opinion the investigation showed that there was no appreciable quantity of undigested plasmon or its phosphorus compounds, casein or paranuclein, in the feces from plasmon. It was apparently completely digested, surpassing meat in this respect.

On the metabolism of matter in the living body, E. B. Rosa (*Phys. Rev., 10 (1900), No. 3, pp. 129–150*).—A method for computing the balance of income and outgo of oxygen and hydrogen from the data usually recorded in experiments with the respiration calorimeter is described. The author believes such calculations are useful and that the weight of the subject should be determined at short intervals and this and other data used as a check on the accuracy of the work.

Farm superintendence, G. E. Day (*Ontario Agr. Col. and Expt. Farm Rpt. 1899, pp. 83–86, fig. 1*).—Brief notes are given on farm superintendence; cattle, sheep, and swine kept at the station; methods of feeding; and the financial affairs of the agricultural college.

White cattle: An inquiry into their origin and history, R. H. Wallace (*Reprint from Trans. Nat. Hist. Soc. Glasgow, n. ser., 5 (1897–1899), Nos. 2, pp. 220–273, figs. 32, pls. 7; 3, pp. 403–457*).—A large amount of historical and other data leads the author to the conclusion that the white breed, commonly called Park Cattle, and White Cattle, are descendants of domesticated cattle which became feral many generations ago. Scotland is regarded as the source of the present English herds of white cattle. The origin of the Scotch herds is not definitely settled. The present publication is regarded as an introductory. An extended bibliography of the subject is given.

Heavy, medium, and light meal rations for fattening steers, G. E. Day (*Ontario Agr. Col. and Expt. Farm Bul. 110, pp. 1–4*).—Noted from other publications (E. S. R., 10, p. 277; 11, p. 664; 12, p. 372).

Pasteurized v. raw skim milk for calves, G. E. Day (*Ontario Agr. Col. and Expt. Farm Rpt. 1899, p. 67*).—A brief account of a test in continuation of previous work (E. S. R., 11, p. 666). The total gain in 4 weeks of 4 calves fed pasteurized skim

[1] München Med. Wchnschr., 46 (1899), No. 26.

milk as part of a ration was 110 lbs. and of 4 calves fed raw skim milk under similar experimental conditions was 105 lbs.

Sheep, hogs, and horses in the Pacific Northwest, J. WITHYCOMBE, H. T. FRENCH, and S. B. NELSON (*U. S. Dept. Agr., Farmers' Bul. 117, pp. 28, figs. 2*).—*Sheep husbandry, J. Withycombe* (pp. 5–16).—The author discusses sheep husbandry in the Pacific Northwest and in western Oregon with special reference to different forage crops, methods of feeding, pasturage, etc. The management of breeding ewes and lambs is also spoken of.

Hog raising in the Northwest, H. T. French (pp. 16–23).—Among the points treated of are breeds and breeding, quality of product, and feeds and feeding stuffs. In the author's opinion, hogs in the Northwest are generally very free from disease.

The horse industry of the Northwest, S. B. Nelson (pp. 23–27).—The horse industry of the past decade is reviewed and the effects on the industry of new inventions discussed as well as the present and prospective demand and the home market.

Alfalfa and red clover hay for lambs, G. E. DAY (*Ontario Agr. Col. and Expt. Farm Bul. 110, pp. 6, 7*).—Summarized from earlier publications (E. S. R., 11, p. 600; 12, p. 373).

Corn v. peas for fattening lambs, G. E. DAY (*Ontario Agr. Col. and Expt. Farm Bul. 110, pp. 7, 8*).—Summarized from earlier publications (E. S. R., 11, p. 667; 12, p. 373).

The Belgian hare, C. C. CHAPMAN (*Pacific Rural Press, 59 (1900), No 3, p. 38*).

DAIRYING—DAIRY FARMING.

A study of dairy cows, C. L. BEACH (*Connecticut Storrs Sta. Bul. 20, pp. 40, figs. 16*).—In order to get some idea of the average production of dairy cows in Connecticut the author collected data during the summer of 1899 as to the production of a number of herds supplying one of the large creameries in the State. A summary of the results showed an average annual yield of butter of 199 lbs. for 392 cows representing 47 herds. Only 9 herds, comprising 68 cows, averaged over 250 lbs. per year. Estimates by the author, based on records of the college herd, show that under conditions existing in the State cows yielding less than 250 lbs. of butter per year are not kept at a profit.

The author discusses variations in the production of individual cows, using illustrations from the records of the college herd, and gives suggestions for increasing the average production and for judging dairy cows.

A tabulated record of the college herd for 1898 is given showing the cost of food and the amount and value of milk and butter produced by each cow with the corresponding profit or loss. The principal facts presented in the record are summarized. The average yield per cow was 5,653 lbs. of milk and 313 lbs. of butter. The best butter cow produced 509 lbs. of butter, at a profit of $42.82 over cost of food, and the poorest cow 172 lbs., at a loss of $4.09. The two most profitable cows for butter were also the most profitable cows for milk. Of the 4 cows in the herd producing butter at a loss, 3 were registered cows of the dairy breeds.

The anatomical and physiological features of the dairy cow are discussed at some length.

A comparative study was made of individual cows as regards type and economy of production. In most cases 2 cows of the same breed representing different types were compared. Illustrated descriptions are given of 12 of the cows of the herd, with deductions from their records. The whole herd was divided into three groups corresponding to the following types: (1) Dairy type, cows spare in form with deep bodies; (2) beef type, cows with large frames and having a tendency to lay on flesh easily; and (3) cows lacking in depth and width of body. The following table summarizes the record of the college herd grouped according to types and breeds:

Average record of cows of different types and breeds.

	Number of cows.	Cost of food.	Amount of milk produced.	Cost of 100 lbs. milk.	Amount of butter produced.	Cost of 1 lb. butter.	Profit from milk at $1.00 per 100 lbs.	Profit from butter at 18c. per lb.
Types:		*Dollars.*	*Pounds.*	*Cents.*	*Pounds.*	*Cents.*	*Dollars.*	*Dollars.*
Dairy	16	41.66	6,190	69	351	12.0	20.24	21.49
Lacking depth	5	39.83	5,322	77	267	14.9	13.40	8.36
Beef	4	38.59	3,916	100	217	18.1	.56	.55
Breed:								
Jersey	4	43.35	5,981	73	371	12.1	16.46	23.47
Grades	14	39.99	5,523	76	314	13.2	15.20	16.46
Guernseys	3	41.40	5,140	83	293	14.3	10.00	11.45
Ayrshires	4	40.65	6,166	69	266	16.0	21.01	7.32
Average of herd	25	40.80	5,653	76	313	13.6	15.72	15.51

"The record shows that in our herd the dairy type is nearly equal to the Jersey and excels the other breeds in production of butter. The dairy type is equal to the Ayrshires and excels the other breeds in the production of milk. On the whole the comparison seems to show that, under the present conditions, the type of the cow is more essential than the breed as indicating the ability to produce milk and butter economically."

Exercise for cows, B. Torssell (*Meddel. K. Landtbr. Styr. 1900, No. 63, pp. 170–172*).—Ten cows were separated into two even lots, one of which (lot A) was kept in the stable, while the other (lot B) was driven about 3.5 kilometers back and forth daily for 10 days. After 10 days the second lot was kept in, while the other one was exercised in the same way as lot B in the first period. The average yield and fat content of milk during a preliminary period of 3 days and during the experiment proper are shown in the following table:

Milk production with and without exercise.

	Preliminary.		With exercise.		Without exercise.	
	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.
	Liters.	*Per cent.*	*Liters.*	*Per cent.*	*Liters.*	*Per cent.*
Lot A, 5 cows	63.47	3.48	55.29	3.60	57.91	3.42
Lot B, 5 cows	58.33	3.46	55.13	3.72	54.87	3.48
Total	121.80	3.47	110.42	3.66	112.78	3.45

In the author's opinion the conclusion seems warranted that the possible lower production obtained by giving the cows exercise in winter is more than compensated for by the favorable influence of this practice on the health and the hardiness of the cows.—F. W. WOLL.

Dairy husbandry, C. B. LANE (*New Jersey Stas. Rpt. 1899, pp. 189–196, 202–269, pl. 1, dgm. 1*).—Deductions from the results of dairy experiments previously reported (E. S. R., 11, p. 883) are quoted, and a detailed account is given of dairy work during the year.

Soiling crops (pp. 192–196).—Tabulated data, including dates of sowing and cutting, yield, and cost of production, are given for a long list of forage crops grown for the dairy herd. Brief notes are also given on the culture and growth of the different crops.

Experiments with different rations (pp. 202–220).—Seven tests of 14 days each and 2 tests of 7 days each were made with 2 cows to study the influence of rations varying widely in character, upon the yield and composition of milk and the economic production of milk and butter. The nine rations compared included the following feeding stuffs in various combinations: Wheat bran, dried brewers' grains, linseed meal, oats, cornstalks, hay, silage, green clover, and sugar beets. The nutritive ratios of the different rations varied from 1:4 to 1:14. The highest yield of milk and fat was produced on a ration having a nutritive ratio of 1:6.5, and the lowest yield on a ration having a ratio of 1:14. With one exception, changing from a wide to a narrower ration increased the yield of milk and fat, and changing from a narrow to a wider ration decreased the yield. A diagram shows the yield and composition of the milk of the cows on the changing rations as compared with like data for cows in the same stage of lactation fed uniformly during the same period. The fat content of the milk during the different periods ranged from 3.66 to 4.26 per cent. Tabulated data in regard to the economy of milk and butter production on the different rations show a net gain over cost of food of 32.9 per cent greater on well-balanced rations than on poorly balanced rations. The results of the study are summarized as follows:

"(1) The feeding of irregular rations caused a wide variation in the yield of milk and fat, and had a tendency to decrease the total yield.

"(2) The feeding of rations varying widely in respect to character and percentage of coarse foods, and amount of different food compounds and total nutrients furnished, had but little influence upon the composition of the milk.

"(3) Milk and butter were produced more economically from well-balanced rations than from rations containing a sufficient quantity of nutrients, but not in the proper proportion."

An experiment with 4 cows comparing a "good" (balanced) and a "poor" (unbalanced) ration was made in continuation of a similar experiment already reported (E. S. R., 11, p. 884). The same cows and practically the same rations were used as in the earlier experiment.

The feeding periods in the present case were shortened to 15 days. On the balanced ration 15.1 per cent more milk and 21.9 per cent more fat was produced than on the unbalanced ration. The gain over cost of food, however, was not marked. "As pointed out in the discussion of the previous experiment, the advantage of the good and more expensive ration is a larger production from the same number of animals, and thus a reduction in the capital required."

The yield and composition of milk obtained when the intervals between milkings are unequal and when they are equal (pp. 220–257).—Seven-day tests of 31 Holstein cows supervised by the station are reported by J. G. Lipman, and the detailed data are summarized to show the average weekly variations in the fat content of the milk of individual cows, proportionate yields of milk and fat at 3 daily milkings at unequal intervals, average yields of milk and fat per hour for the unequal periods between milkings, and the average fat content of the milk of the cows grouped according to age. Some of the author's deductions from the study follow:

"The difference between the highest and lowest daily average per cent of fat for any 7 consecutive days is under normal conditions usually less than 0.45 per cent. . . .

"When the intervals between milkings are unequal, there is a tendency to produce proportionately more fat after the shortest interval.

"When the intervals between milkings are unequal, there is a tendency for stall-fed cows to give proportionately more milk at the morning's milking.

"When the intervals between the two afternoon milkings are equal, the yields of milk are practically the same, but the yield of fat for the noon milking is greater.

"When the cows are on pasture, and the periods between milkings unequal, there is a tendency to yield more milk, in proportion, at the noon milking."

The average fat content of the milk of 6 cows, 2 years old, was 3.33 per cent; 6 cows, 3 years old, 3.62 per cent; 8 cows, 4 years old, 3.23 per cent, and 11 full-aged cows, 3.26 per cent.

In 2 experiments at the station to determine at what period of the day the most milk and fat are produced and the highest and lowest percentage of fat found, 4 cows were milked at 5 a. m. and 5 p. m., and 5 cows were milked at 5 a. m., 1 p. m., and 9 p. m. In another experiment to compare milking cows two and three times a day 4 cows were milked at equal intervals twice a day during the first and third periods and three times a day during the second period. Complete data for the 3 experiments are tabulated and the following summary is given:

"When the cows were milked at equal intervals twice daily, 51.9 per cent of the total milk was produced in the morning, and 41.8 per cent at night. Of the total fat, 50.6 per cent was produced in the morning and 49.4 at night. Of the 76 tests for percentage of fat, 59, or over three-fourths, were highest at night.

"When the cows were milked at equal intervals, three times daily, 36 per cent of the total milk was produced at 5 a. m., 32.8 per cent at 1 p. m. and 31.2 per cent at 9 p. m. Of the total fat, 33.3 per cent was produced at 5 a. m., 35.1 per cent at 1 p. m. and 31.6 per cent at 9 p. m. The highest percentage of fat occurred at

1 p. m., or the period nearest the noon hour, and the lowest percentage in the morning.

"When 4 cows were changed from twice to three times milking, they gained 3.03 per cent in yield of milk and 0.78 per cent in yield of fat. The average per cent of fat decreased 0.09.

"When 4 cows were changed from three times milking to twice, they decreased 10.3 per cent in yield of milk and 9.4 per cent in yield of fat, and the average per cent of fat increased 0.04.

"The results of milking three times daily indicate that a third milking will not pay as a regular farm practice."

Cost of producing milk (pp. 257–260).—The cost of the milk production of the herd is given for the year ended April 1, 1899. The data contained in the present report, as well as similar data for the two preceding years, were summarized in the bulletin of the station previously referred to.

Soiling crop rotation (pp. 261, 262).—A table gives the total yield and amount of nutrients obtained per acre from the various combinations of soiling crops grown during the year. A continuous supply of forage was furnished the dairy herd from May 1 to November 1.

Dairying in relation to soil exhaustion (pp. 263, 264).—The amount of fertilizing elements contained in the feeding stuffs purchased and in the milk produced by the station herd for 3 years is given in tabular form. The results show a decided gain to the farm in fertilizing elements.

Record of the dairy herd (pp. 264–269).—A record of 12 cows is given for the year ended April 1, 1899. The principal results are summarized in the following table:

Records of best and poorest cows for milk and butter production.

	Annual yield.	Value of product.			Cost of feed.	Gain over cost of feed with—		
		Milk at 1 ct. per lb.	Milk at 3 cts. per qt.	Butter at 20 cts per lb.		Milk at 1 ct. per lb.	Milk at 3 cts. per qt.	Butter at 20 cts. per lb.
Milk production:	*Pounds.*							
Best cow	10,169	$101.69	$139.95	....	$46.32	$55.37	$93.63	....
Poorest cow	5,090	50.90	70.05	....	46.32	4.58	23.73	....
Average cow	6,965	69.65	95.85	....	46.32	23.33	49.53	....
Butter production:								
Best cow	484	....	....	$96.80	46.32	....	....	$50.48
Poorest cow	247	....	....	49.40	46.32	....	....	3.08
Average cow	318	....	....	63.60	46.32	....	....	17.28

The average waste for 3 years in handling, cooling, bottling, and delivering milk was 9 per cent.

Report of the professor of dairy husbandry, H. H. DEAN (*Ontario Agr. Col. and Expt. Farm Rpt. 1899, pp. 54–74*).—Notes are given on the work of the dairy school during the year, and various experiments, partly in continuation of previous work (E. S. R., 11, pp. 681, 683), are reported.

Care of milk for cheese making (pp. 55–58).—Experiments were con-

ducted during the summer to study the effect of different methods of treatment on the sweetness of milk and on the quality of curd and cheese. During the hot weather aeration alone was not found sufficient to keep milk sweet over night and in good condition for cheese making the following morning. A small quantity of ice in a can set in the milk was more effective than aeration. Milking and aerating in the stable or pasture did not seem to affect the occurrence of gassy curds, nor did the rejection of the first milk drawn prevent this trouble. "A good flavored starter in the milk seems to be the best remedy for gassy and other bad flavors. . . . When the cows are healthy and are fed on clean food and are milked in a cleanly manner, in a clean place, aeration is probably of no particular advantage to milk for cheese-making."

During July and August several experiments were made to determine to what temperature milk should be cooled on Saturday evening in order to have it in good condition on Monday morning. The results indicated that during the summer milk should be cooled to 58 to 60°, and in hot weather to 50 to 55° in order to keep it sweet over Sunday.

Careful v. rough handling of curd (pp. 58, 59).—In each of 3 tests, 1,200 lbs. of milk was divided into 2 equal lots and treated alike, except that one lot was handled very roughly at cutting and during heating, while the other lot was handled as carefully as possible. Careful handling increased the yield of cheese. The quality was practically the same in each case.

Curing cheese at different temperatures (pp. 59–61).—Cheese made at the college and at 2 factories was cured at temperatures of about 60, 65, and 70°. Cheese cured at 60° lost about one-half per cent less in weight than cheese cured at 70°, and was also better in quality. The results were the same with cheeses weighing 30 and 75 to 80 lbs. In 11 experiments cheese cured at 69° for one week and then finished at 60 or 65° was compared with cheese cured at 60, 65, and 69° for the whole time. The results indicated no advantage in curing at high temperatures for a week. The cheese cured at 60° scored the highest.

A bad flavor in cheese (pp. 61, 62).—Notes are given on the occurence of a bad flavor in curd and cheese in a large number of factories, and a method for treating the curd to overcome the difficulty is quoted.

Methods of controlling temperature in cheese-curing rooms during hot weather (pp. 62–65).—Notes are given on the construction and cost of subearth ducts in a number of factories visited by the author. The use of water, fans, and compressed air for cooling curing rooms is also briefly discussed.

Effect of pasture on the fat content of milk (pp. 65, 66).—The average fat content of the milk of the dairy herd for 17 days before the cows were turned out to pasture was 3.69 per cent in the morning and 3.8

per cent in the evening. For the first 17 days on pasture the average fat content of the morning's milk was 4.36 per cent, and of the evening milk 4.47 per cent. The results agree with those previously obtained.

Changes in colostrum milk during 21 milkings (p. 66).—Determinations with the Quevenne lactometer and Babcock test were made of the milk of 5 cows for the first 21 milkings after calving. The addition of sulphuric acid to the first and second milkings gave a decided purple tinge to the precipitate. This is suggested as a method for detecting colostrum milk. The data for the tests are tabulated and summarized as follows:

"There was a gradual decrease in the percentage of fat and the percentage of solids-not-fat with three cows, and a decrease of the solids-not-fat in the milk of all five cows from the first to the twenty-first milking. In the case of one cow, an Ayrshire grade, the percentage of fat increased from the first to the twenty-first milking, while another grade Ayrshire was lower in fat for the first eight milkings, then increased, and afterwards decreased.

"Milk is not normal until the eighth or ninth milking after calving, and in some cases the twelfth or fourteenth milking contains an abnormal proportion of solids-not-fat."

Dilution creamers or "separators" (pp. 67, 68).—Tests were made of the Hydro-lactic, Wheeler, and Brampton cans in comparison with the Cooley can. Milk was diluted one-half and set at room temperature in the Hydro-lactic, Wheeler, and Cooley cans. Undiluted milk was set in the Brampton and Cooley cans, which were kept in ice water. The results showed little or no advantage in the use of dilution creamers as compared with ordinary cans in which milk is set in ice water without dilution. Setting for but 3 to 4 hours in the dilution process, as recommended by the manufacturers of the dilution cans, was less satisfactory than setting for a longer time. The dilution process lowered the quality of the butter and lessened the value of the skim milk.

Ripening cream with different percentages of starter (p. 68).—The cream was ripened without the use of a starter as compared with the addition of 5, 15, and 20 per cent starter. "The starter caused the cream to ripen more quickly, but there was little or no difference in the quality of the butter. This agrees with the results obtained for the past two years."

Ripening cream at different temperatures (p. 69).—In each of 21 experiments made during July and August cream was divided into 2 lots, one of which was ripened at 70 to 75° and the other at 55 to 60°. The yield and quality of the butter favored ripening at the lower temperature, agreeing with results previously obtained.

Pasteurizing milk and cream for butter making (pp. 69–71).—Experiments were conducted during April and May to study the effect of pasteurization in butter making. The butter made in the experiments

was sent to two firms from which scorings were obtained. The results are summarized in part as follows:

"There was less loss of fat in the skim milk from pasteurizing the whole milk before separating.

"There was less volume of cream from pasteurized milk, but the cream was richer.

"By using a starter after cooling there was no difficulty in ripening the cream from pasteurized milk.

"The pasteurized cream churned in less time than the raw cream.

"The yield of butter per 1,000 lbs. of milk was 0.89 lb. greater from the unpasteurized milk. . . .

"All the trials indicated that butter from pasteurized milk had better keeping qualities, although when first made there was little or no difference in the quality. . . .

"Pasteurized skim milk kept sweet from 24 to 48 hours longer than the skim milk from the separator where the whole milk was not heated to 160°."

Mangels v. turnips fed to cows for butter making (p. 71).—Butter made from cows fed mangels scored 2.3 points higher than that from cows fed turnips.

The dairy herd (pp. 71, 72).—A tabulated record of the dairy herd of 23 cows for the year is given, with a summary of the principal data.

Milk tests at the fall fairs (p. 73). -Records of tests of 41 cows are tabulated.

Foreign coloring matter in milk, A. E. LEACH (*Jour. Amer. Chem. Soc., 22 (1900), No. 4, pp. 207–210*).—"Out of 23,098 samples of milk collected throughout the State [of Massachusetts] during 5 years (1894–1898) 151 samples, or 0.6 per cent, were found to contain foreign coloring matter. Of these samples about 88 per cent contained annatto, approximately 10 per cent were found with an aniline orange, and about 2 per cent with caramel. . . . About 95 per cent of the milks found colored in Massachusetts showed on analysis the fraudulent addition of water."

The method employed by the author for the examination of samples suspected of being colored is described in detail.

The ripening of cream, H. W. CONN (*Connecticut Storrs Sta. Bul. 21, pp. 24*).—This is a general discussion of the purposes, cause, and control of cream ripening; the effect of different species of bacteria; the use of pure cultures in the United States and Europe; results of the use of pure cultures; methods employed in the use of pure cultures; and the use of starters with and without pasteurization. The author's summary of the discussion follows:

"(1) The market price of butter depends in a large degree upon the character of the ripening of the cream.

"(2) The only method the butter maker has of controlling this ripening is by the use of 'starters,' followed by a maintenance of a proper temperature.

"(3) The most logical method of using these starters is first to pasteurize the cream and then inoculate it with a pure culture of a favorable species of bacteria. This method is almost universal in Denmark, but it produces very mild-flavored butter

and has not been extensively adopted elsewhere. It is better adapted to European taste than to the taste of lovers of butter in the United States.

"(4) The use of starters without pasteurization has been quite widely adopted in American creameries. This is a less logical method, but the results are satisfactory. The butter obtained is more highly flavored than that from pasteurized cream.

"(5) The starter used may be either a commercial starter or a natural starter. There is little to choose between them. The latter is more commonly used in the United States. The question whether the one or the other should be used is largely a matter of convenience.

"(6) The use of starters will not make good butter out of poor cream."

Report of the bacteriological department, M. N. Ross (*Ontario Agr. Col. and Expt. Farm Rpt. 1899, pp. 96–100, fig. 1*).—Mention is made of the distribution of starters among various butter and cheese makers, and brief notes are given on the use of starters.

Bacteriological examinations showed that cheese cured at a low temperature had a higher bacteria content during the first few days than cheese cured at a high temperature. Cheese made in the fall had a higher germ content than cheese made in the spring and summer. The superior flavor of cheese cured at a low temperature and also of fall cheese is therefore attributed to the increased number of bacteria present in such cheese. *Bacillus coli communis* thrived better in cheese cured at a low temperature, and liquefying bacteria grew better in cheese cured at a high temperature.

A species of Torula was isolated from samples of bitter cheese obtained from several factories. The characters of this organism are noted. This trouble which is known as "bitter milk" caused considerable loss to cheese makers of Ontario during the summer. Further investigations are necessary before suggestions for the exclusion of this germ from milk can be made.

Two samples of water used in factories where much trouble from gassy curd was experienced were examined. In each case a different species of gas-producing bacteria was isolated. A pure culture of lactic-acid germs was used with one of the gas-producing species with very beneficial results.

Practical hints for the dairyman, F. S. Cooley (*Massachusetts State Bd. Agr. Rpt. 1899, pp. 273–288*).—This treats of soiling crops for dairy cows, cow stables, selection and testing of cows, and the care of milk.

Dairying, W. R. Sessions (*Massachusetts State Bd. Agr. Rpt. 1899, pp. 45–73*).—A general discussion of the subject.

Dairy farming, A. M. Soule (*Tennessee Sta. Rpt. 1899, pp. 25–28, figs. 3*).—A popular discussion on the selection, breeding, and testing of dairy cows, with suggestions for keeping a herd record.

Feeding the dairy cow, A. M. Soule (*Tennessee Sta. Rpt. 1899, pp. 29–31, fig. 1*).—This discusses in a popular manner the composition of milk, general principles of feeding, and the relative value of pasture and soiling crops for milk production. Several rations for dairy cows are suggested.

Mangels v. sugar beets for milk production, G. E. Day (*Ontario Agr. Col. and Expt. Farm Rpt. 1899, pp. 76, 77*).—An experiment previously noted (E. S. R., 11, p.

688) is summarized and a similar comparative test of mangels and sugar beets for milk production is reported. The experiment included 4 cows and lasted 4 weeks. "Everything considered, these experiments indicate that there is very little, if any, difference between mangels and sugar beets as foods for stimulating the flow of milk. It must be remembered, however, that these experiments have no bearing upon the relative value of these foods for maintaining life or producing fat."

Mangels v. sugar beets for milk production, G. E. Day (*Ontario Agr. Col. and Expt. Farm Bul. 110, pp. 46*).—An account is given of 2 comparative tests of mangels and sugar beets for milk production previously reported (E. S. R., 11, p. 688; 12, p. 388).

Milking record experiment, J. A. Murray (*Ann. Rpt. Field Expts. Agr. Dept. Univ. Col. Wales, 1899, pp. 26-30*).—Records of 5 herds of 5 cows each for 3 months were obtained for the purpose of comparing Welsh Black and Shorthorn breeds of cattle for dairy purposes. The results, while not considered conclusive, showed a much larger yield of milk in favor of the Welsh Black breed.

Concerning the cows' milk in Varna, Bulgaria, C. Strzyzowski (*Oesterr. Chem. Ztg., 3 (1900), No. 7, pp. 157, 158*).—The author reports analyses of 7 samples of milk. He states that nothing corresponding to a modern milk control exists in Bulgaria and the milk supply has been little studied. Where a control exists it usually consists in determining the specific gravity and testing for the presence of starch or brain matter, although adulterations of this kind are said to occur very rarely.

On the variability of the dry matter of milk and its value for judging market milk, A. Reinsch and H. Lührig (*Ztschr. Untersuch. Nahr. u. Genussmtl., 3 (1900), No. 8, pp. 521-531*).

The value of a regulated milk control for cities, A. Lamb (*Ztschr. Untersuch. Nahr. u. Genussmtl., 3 (1900), No. 7, pp. 472-475, dgm. 1*).

Milk and milk bacteria, S. Serkowsky (*Milch und ihre Bakterien. Warsaw, 1900, pp. 129; rev. in Ztschr. Untersuch. Nahr. u. Genussmtl., 3 (1900), No. 8, p. 591*).

Lactic acid bacteria, M. E. McDonnell (*Inaug. Diss., Kiel, 1899, pp. 60, pls. 3*).—This contains the results of extended observations and investigations on the growth of lactic-acid bacteria in different media, milk fermentations, and the morphology and physiology of lactic-acid bacteria, and their maximum, minimum, and optimum temperatures. A classification is given of the different lactic-acid germs and the propagation of pure cultures for dairy purposes is considered.

The coagulation of milk by rennet, Duclaux (*Ind. Lait., 25 (1900), Nos. 30, pp. 233, 234; 31, pp. 241, 242; 32, pp. 249, 250*).—The action of rennet on the different milk constituents is discussed.

Effect of sewage water on renneted milk, G. S. Thomson (*Jour. Agr. and Ind. South Australia, 3 (1900), No. 11, pp. 911-914, figs. 3*).—Sewage water obtained from a drain running from a cheese-making room and added to pasteurized milk produced a stringy and gassy curd. This trouble was observed in 2 factories.

The effect of churning on fat globules, G. A. Flickinger (*Tennessee Sta. Rpt. 1899, pp. 34-36, fig. 1*).—A popular discussion.

The normal bacterial invasion of the cow's udder, V. A. Moore (*Proc. Soc. Prom. Agr. Sci. 1899, pp. 110-113*).—The author calls attention to the bacterial invasion of the udder as one of the sources of milk contamination, basing his discussion of the subject mainly on investigations previously noted (E. S. R., 10, p. 1094; 12, p. 184).

VETERINARY SCIENCE AND PRACTICE.

The problem of infection and immunity, A. D. Pawlowsky (*Ztschr. Hyg. u. Infectionskrank., 33 (1900), No. 2, pp. 261-312*). In this article the author reports the results of extensive experiments

concerning the fate of pyogenic organisms in susceptible and immune animals. After organisms have come to be located in the hypodermal connective tissue, they are rapidly carried into the blood and internal organs. This is accomplished largely by means of the lymph currents. The observed microscopical facts in connection with this problem lend no aid to the theory that pathogenic organisms may be carried from the source of infection to other parts of the body through the agency of phagocytes. Many pathogenic organisms which have become located in the subcutaneous connective tissue are later excreted in the urine and bile. This excretion is occasionally very extensive. The early period of primary excretion of the pathogenic organisms is called by the author the elimination period of infection. A bibliography of 130 titles on the literature of the subject is appended to the article.

Report of the biologist, J. NELSON (*New Jersey Stas. Rpt. 1899, pp. 273–320, pls. 4*).—The author reports that among the college dairy herd as many abortions occurred during the year following the disinfection treatment as during the preceding year.

Details are given of a number of autopsies upon animals which had been condemned after receiving the tuberculin inoculation. The author gives a summary of observations extending over a period of 6 years upon the college dairy herd with reference to the extermination of tuberculosis in this herd. From observations made during this time, the author concludes that allowance should always be made for individual differences in the reaction to the tuberculin test; that, as a general theory, a resting period of several months should be allowed between any 2 tuberculin tests; and that the course of the disease does not seem to be affected by tuberculin injections, either by way of aggravation or alleviation of the disease. A general discussion is presented of the contagiousness of tuberculosis, on the curative action of tuberculin, on the advisability of a reinjection, the length of period between injections, the rapidity of development of tuberculosis, and the detection of tuberculosis by physical symptoms.

The author made a study of a bacteriological disease of ducks which resembled to some extent chicken cholera. An outbreak of this disease occurred in a flock of 100 ducks and as the death rate became large it was recommended that 1 per cent carbolic acid be given in the drinking water and that an astringent be given in soft feed. These remedies seemed to have a decidedly beneficial effect in checking the disease. The author made cultures of the micro-organism and inoculated one of the partly recovered ducks from the diseased flock. A mild attack of the disease followed this inoculation. The disease in question seemed to be confined largely to the small intestines. The liver appeared normal and the other *post-mortem* findings were not strictly like those of chicken cholera. Inoculations of pure cultures of the bacillus in guinea pigs were without result.

The author gives a detailed description of various bacteriological apparatus upon which improvements have been made, including a tube carrier for a hand centrifuge, a thermo-regulator, sterile pipette for plate cultures, and a test-tube holder. Notes are also given on the use of the platinum loop and on methods of detecting tubercle bacillus in tissues.

Results of the Lorenz method of inoculation against hog cholera with Prenzlau vaccine during the years 1897–1899, E. JOEST and A. HELFERS (*Berlin. Tierärztl. Wchnschr., 1900, No. 11, pp. 121–124*).—The number of hogs inoculated was 217,376. In general the inoculations were endured by the hogs without any disturbance of the general health conditions. The number of deaths which were attributed to inoculation by this method was 40, of which 31 cases were not carefully investigated. One case showed necrosis of the cervical ligament, 3 erysipelas of the head, 1 peritonitis, 1 articular inflammation, and 2 gastro-enteritis. The number of cases of hog cholera which developed in consequence of the injection of cultures was 202. In these cases the disease was manifested within from 2 to 7 days after the inoculation. Sixty-four of these cases recovered spontaneously. The inoculation failed to produce a sufficiently complete immunity in 155 cases which became later infected with the natural disease. The question whether inoculated hogs transmit the disease to uninoculated hogs was answered in the negative in nearly all the reports. Of the hogs which were suffering with hog cholera, 68.8 per cent were cured by the method.

Partial paralysis and crippling of swine, J. H. REED and G. E. DAY (*Ontario Agr. Col. and Expt. Farm Bul. 110, pp. 8–12*).—During the winter and spring months many pigs become somewhat paralyzed or lame from an apparent rheumatic affection. In paralysis the appetite is variable and the hind limbs are so affected that locomotion is scarcely possible. In rheumatic affections the symptoms are similar to those of paralysis, with the exception that the joints are frequently swollen and sensitive. This form of paralysis is usually the result of digestive disturbances associated with constipation. These digestive troubles are due to overfeeding or improper feeding and lack of exercise. The rheumatic troubles are mostly caused by improper buildings, poor ventilation, or damp sleeping places.

The curative treatment for these affections consists largely in correcting these faults in diet or surroundings, the use of a tonic, such as nux vomica, and suitable purgatives. Under the head of "Correctives," the author refers to substances which are not strictly foods, but which assist in bringing about a normal digestive action. Among these substances may be mentioned fresh earth, ashes, and charcoal. Suggestions are given as to proper plans for building the piggery, so that damp floors may be avoided and proper ventilation secured.

Toxicological experiments with nitrate of strychnine upon geese, ducks, chickens, and pigeons, J. SCHNEIDER (*Monatsh. Prakt. Thierh., 11 (1900), No. 6, pp. 245–269*).—The experiments reported upon in this paper included hypodermic injections of strychnine in the breasts of domesticated birds and the feeding of strychnine by way of the mouth. The general results obtained from these experiments may be tabulated as follows:

Dose of strychnine per kilogram live weight.

	Given hypodermically.		Given by way of mouth.	
	Therapeutic dose.	Minimum lethal dose.	Therapeutic dose.	Minimum lethal dose.
	Mg.	*Mg.*	*Mg.*	*Mg.*
Geese	0.4	1.0	0.6	2.5
Ducks	0.5– .6	0.1–1.1	1.5–2.0	3.0–4.5
Chickens	1.0	3.0	2.0–3.0	30.0
Pigeons	.5– .75	1.0	6.0	8.5

From these data it appears that pigeons are least susceptible to internal doses of strychnine so long as the experiments are confined to therapeutic doses, while chickens manifest the greatest resisting power against lethal doses. The experimental birds which were killed, whether by internal or hypodermic doses of strychnine, were cooked and eaten without experiencing any peculiarity in the taste of the meat or any effects from the strychnine.

Handbook of meat inspection for veterinarians, physicians, and judges, R. OSTERTAG (*Handbuch der Fleischbeschau für Tierärzte, Ärzte und Richter. Stuttgart: Ferdinand Enke, 1899, 3. ed., pp. 902, figs. 251, pl. 1*).—This book is a general treatise on the subject of meat inspection, and contains discussions of the following related matters: Government regulations of the sale of meat, inspection of animals before slaughter, inspection of carcasses, the normal appearance of various organs, abnormal physiological conditions, general pathology of slaughtered animals from the health officers' standpoint, organic diseases of special importance, anomalies of the blood, cases of poisoning, animal parasites, plant parasites, slaughter for acute infectious diseases, *post-mortem* changes in meat, coloring and inflation of meat, preservation of meat, boiling, and steam sterilization.

The taking of samples for trichina inspection, C. NOACK (*Deut. Thierärztl. Wchnschr., 8 (1900), No. 8, pp. 66, 67*).—Detailed directions for the selection of samples from meat to be inspected in order that the inspection may give reliable results.

The examination of condemned meat, H. L. ELLERMAN (*Tijdschr. Veeartsenijk en Veeteelt, 27 (1900), No. 2, pp. 99–126*).—A detailed account of the methods of inspecting meat for the presence of various diseases.

The meat inspection law of the United States, A. MÖLLER (*Ztschr. Fleisch u. Milchhyg., 10 (1900), No. 6, pp. 101–106*).—A critical examination of the law of this country concerning meat inspection.

The treatment of acute muscular rheumatism with acetanilid, E. ZINCKE (*Deut. Thierärztl. Wchnschr., 8 (1900), No. 8, pp. 65, 66*).—This article discusses the symptoms of muscular rheumatism and reports the successful use of acetanilid in treating it.

The determination of the value of tetanus antitoxin and its use in human and veterinary medicine, E. BEHRING (*Deut. Med. Wchnschr., 26 (1900), No. 2, pp. 29–32*).—The author states that in order that tetanus antitoxin may be fairly tested it is necessary that treatment with it shall be begun not later than 30 hours after the appearance of tetanus symptoms. Intravenous injection is recommended in the place of hypodermic.

Pathogenesis of local lesions of infectious origin, M. DE VIEDMA (*Gac. Med. Vet., Madrid, 24 (1900), No. 159, pp. 101–104*).—A brief study of croupous and diphtheritic membranes, gangrene, and tuberculosis.

The cocco-bacillus of Pfeiffer, G. ROSENTHAL (*Compt. Rend. Soc. Biol. Paris, 52 (1900), No. 11, pp. 266–268*).—Experiments were tried with this organism in association with other organisms of variable virulence. Mice inoculated with a mixture of pneumococcus and this cocco-bacillus died of septicæmia. Rabbits inoculated in the lung with a mixture of cocco-bacillus and an old culture of staphylococcus succumbed to pulmonary congestion in the course of a few days.

The bacillus of Koch in the milk of human tubercular patients, H. ROGER and M. GARNIER (*Compt. Rend. Soc. Biol. Paris, 52 (1900), No. 8, pp. 175–177*).—The tubercle bacillus was found in the milk of a tuberculous woman although there was no evidence of mammary lesions. The author calls attention to the bearing of this observation upon the question of the infectiousness of cows' milk.

Serum diagnosis of tuberculosis, E. BENDIX (*Deut. Med. Wchnschr., 26 (1900), No. 14, pp. 224, 225*).—Brief notes on the results obtained by the application of this method to cases of tuberculosis of man.

The effect of different medicaments in the treatment of experimental tuberculosis, J. HÉRICOURT and C. RICHET (*Compt. Rend. Soc. Biol. Paris, 52 (1900), No. 12, pp. 275–278*).—The authors conducted numerous experiments in inoculating dogs with tuberculosis and in testing the therapeutic value of various medical agents. During these experiments it was found that all such agents which were tried had a greater or less effect in checking the progress of the disease. Among the substances which were used, the following may be mentioned: Common salt, urate of sodium, aristol, creosote, camphor, Liebig's extract of beef, bichlorid of mercury, iodin, terebinthine, lead, and thallium.

The present status of tuberculin injection, with special reference to practical experiments with this substance, OSTERTAG (*Ztschr. Fleisch u. Milchhyg., 10 (1900), No. 7, pp. 121–130*).—The author discusses the literature of the subject with reference to actual practical results which have thus far been obtained in different countries in combating tuberculosis by means of tuberculin.

Attention is called to the importance of destroying all animals in which clinical evidence of tuberculosis can be seen, and especially cows with chronic cough, chronic diarrhea, and tuberculosis of the udder. The author believes that all dangerous tuberculous animals may be destroyed and that by the aid of tuberculin herds of cattle may be reared which are entirely free from tuberculosis.

The influence of oxygen under pressure on Koch's bacillus in liquid cultures, F. ARLOING (*Compt. Rend. Soc. Biol. Paris, 52 (1900), No. 12, pp. 291, 292*).—Oxygen under pressure of from $1\frac{1}{2}$ to $2\frac{1}{2}$ atmospheres exercises a very marked restraining influence upon the development of Koch's bacillus in liquid media. The length of time seems to be more important than the intensity of the pressure. The influence of oxygen under pressure was sufficient to destroy completely the virulence of cultures of the tubercle bacillus as shown by subsequent experiments in inoculating rabbits.

The treatment of tuberculosis in the nineteenth century, BÄUMLER (*Berlin. Klin. Wchnschr., 37 (1900), No. 14, pp. 293–298*).—An account of the application of various surgical and medicinal treatments for tuberculosis, together with notes on the use of tuberculin for the diagnosis of the disease in its earlier stages.

Tuberculosis in man and cattle, J. LAW (*Country Gent., 65 (1900), No. 2457, pp. 176, 177*).—A controversial article in which arguments are presented to prove the identity of human and bovine tuberculosis.

Prevention of bovine tuberculosis, E. NOCARD (*Jour. Agr. [Paris], 11 (1900), No. 120, pp. 56-59*).—A general discussion of the regulations which have been found most effective in controlling this disease.

An experiment in producing immunity against foot-and-mouth disease by feeding cooked milk from diseased animals, SCHMIDT (*Hessische Landw. Ztschr., 70 (1900), No. 9, pp. 108, 109*).—The author conducted experiments during which 10 pregnant cows were fed with cooked milk from other animals which were suffering from foot-and-mouth disease. Each cow received 2 liters of such milk a day, which had been cooked for a quarter of an hour. None of these cows contracted the disease although they were thoroughly exposed to infection.

An attempt to produce immunity against foot-and-mouth disease by feeding cooked milk from diseased animals, SCHMIDT (*Berlin. Tierärztl. Wchnschr., 1900, No. 8, pp. 86, 87*).—The author states that he has recommended this method to stock owners and farmers in producing immunity against foot-and-mouth disease. It was observed that calves and pigs were rendered immune against the disease by this method. Ten cows received daily 2 liters of milk from cows which had had severe attacks of the disease. The milk was cooked for 15 minutes. The cows were much exposed to the disease but none of them contracted it.

Spaying cows, J. WESTER (*Tijdschr. Veeartsenijk en Veeteelt, 27 (1900), No. 2, pp. 127-162*).—This article contains an elaborate discussion of the spaying methods which have been proposed by different authors, and a bibliography of the subject is appended.

Milk fever, W. O. ROBERTSON (*Vet. Jour., 50 (1900), No. 298, pp. 183-189*).—A general discussion of the symptoms, etiology, and treatment of this disease.

The etiology of parturient paresis, W. A. THOMAS (*Amer. Vet. Rev., 23 (1900), No. 11, pp. 798, 799*).—The lesions of this disease are said to be in the brain and spinal column.

Parturient fever, H. S. SMITH (*Amer. Vet. Rev., 23 (1900), No. 10, pp. 702-708*).—The author maintains that this disease is not due to disturbances of metabolic processes in the udder alone, but is due to general autointoxication. In the treatment of cases of parturient fever, the author used iodid of potash by way of mouth and not as injections in the udder. Good results were obtained by this method, and the author suggests that hypodermic injections of iodid of potash might also give good results.

General observations on the method of adherence of cestodes to the intestinal wall, P. MINGAZZINI (*Extr. Arch. Ital. Biol., 32 (1899), No. 3, pp. 12, figs. 6*).—From a study of microscopic sections of the scolex of cestodes attached to the intestinal walls, the author presents a detailed account of the exact manner of such attachment.

Parasitological notes, B. GALLI-VALERIO (*Centbl. Bakt. u. Par., 1. Abt., 27 (1900), No. 9, pp. 305-309, figs. 4*).—An account of an epizootic disease of laboratory guinea pigs caused by *Trichomonas caviæ*.

Poisoning with Agrostemma githago, K. KRONACHER (*Wchnschr. Tierheilk. u. Viehzucht, 44 (1900), No. 12, pp. 109-115*).—The author discusses the clinical symptoms of 5 cows which were supposed to have been poisoned by this plant. From a study of these cases, the author came to the conclusion that the seeds of this plant, which were fed along with other material, had been crushed and that therefore the saponin contained in them came in contact with the mucus lining of the stomach and alimentary tract.

Pathological-anatomical conditions in poisoning by ricin, F. MÜLLER (*Beitr. Path. Anat. u. Allg. Path., 27 (1900), No. 2, pp. 331-348, pl. 1*).—Samples of the blood

of experimental animals were drawn about 14 hours after giving a lethal dose of ricin. Immediate changes were found to have been produced in the relative proportion of the small lymphocytes, the large lymphocytes with round nuclei, polynuclear cells, and eosinophilous cells. The marrow of hollow bones, the liver, and kidneys were also examined under the microscope, and detailed descriptions are given of the changes in their miscroscopic structure under the influence of ricin poisoning.

Treatment of infectious diarrhea of calves with tannoform, SCHÜNHOFF (*Berlin. Tierärztl. Wchnschr., 1900, No. 14. pp. 101, 102*).—The author reports that a treatment of young calves with calomel and tannoform gave good results in preventing the appearance of this disease.

Husk or hoose in calves, M. J. CLEARY (*Irish Agr. Organization Soc. Leaflet 9, p. 1*).—An account of the etiology and treatment of verminous bronchitis.

Public inoculation against hog cholera in Würtemberg, REINHARDT (*Deut. Thierärztl. Wchnschr., 8 (1900), No. 13, pp. 109, 110*).—A statistical account of the number of animals inoculated, the quantity of inoculation material used for each animal, and the price charged for the operation.

The preparation of a swine-plague serum, W. NIEBEL (*Deut. Thierärztl. Wchnschr., 8 (1900), No. 10, p. 83*).

Hydrophobia in the horse, C. W. EDDY (*Agr. Student, 6 (1900), No. 6, pp. 113–115*).—Brief notes on the symptoms of this disease.

Rabies in the District of Columbia, D. E. SALMON (*U. S. Dept. Agr., Bureau of Animal Industry Circ. 30, pp. 15*).—A controversial article in reply to certain criticisms upon the action of the Commissioners of the District of Columbia in issuing a muzzling order to prevent the spread of rabies. The circular is for the most part occupied in establishing the proposition that rabies is a real disease.

The clinical diagnosis of rabies, PETER (*Berlin. Tierärztl. Wchnschr., 1900, No. 12, pp. 133–136*).—A report of detailed observations on the relative frequency and value of various clinical symptoms in the diagnosis of rabies.

The lesions of rabies in dogs and post-mortem diagnosis of this disease, G. HEBRANT (*Ann. Med. Vet., 49 (1900), No. 2, pp. 76–81*).—The most constant lesions of this disease in dogs are found in the peripheral cerebro-spinal and sympathetic ganglia, and consist in an atrophy, invasion, destruction of the nerve cells, and formation of neomorph cells which appear between the nerve cells and their epithelial capsule.

Fowl cholera, H. DE COURCY (*Irish Agr. Organization Soc. Leaflet 7, p. 1*).—Popular notes on the nature and treatment of this disease.

Concerning diphtheria of birds, P. CAGNY (*Rec. Med. Vet., Paris, 8. ser., 7 (1900), No. 4, pp. 83–85*).—Brief notes on the relationship between fowl diphtheria and diphtheria of man.

Report of the bacteriological department, M. N. ROSS (*Ontario Agr. Col. and Expt. Farm Rpt. 1899, pp. 93–96*).—The author made a study of the roup of chickens. A number of experiments were conducted in inoculating chickens suffering from this disease with antidiphtheria serum. Only 1 chicken recovered as a result of the inoculation, and it was doubtful whether this recovery was due to the serum or to the good care given the fowls. The author reports a number of cases of mycosis in fowls, and discusses the nature, cause, and methods of treatment of this disease.

Regulations for the control of contagious diseases of live stock, C. CURTICE (*North Carolina Dept. Agr., Biol. Dir., 1900, pp. 32, map 1*).—This pamphlet contains copies of the various regulations of the State regarding quarantine and the control of contagious diseases in live stock, together with suggestions regarding the burial of carcasses, the destruction of cattle ticks, and the treatment of tick fever.

AGRICULTURAL ENGINEERING.

A new dairy barn, A. M. SOULE (*Tennessee Sta. Rpt. 1899, pp. 9-18, figs. 11*).—A description, with drawings, is given of the barn completed at the station in the early part of 1899, at a cost of about $5,000:

"The building is a frame structure 54 by 73 ft. 6 in., exclusive of the silos, which are 18 by 30 ft., and an annex which is 18 by 50 ft. . . . The silos are situated at the south end of the barn, some 10 ft. being under ground. This brings them on a level with the basement, and, as they open into the cow stable, it materially lessens the labor of feeding. . . .

"The annex on the west side of the barn is two stories high. In the basement are stalls for bulls and calves, while the upper story is devoted to the various wagons and implements needed in farm work. . . .

"The barn is built into the side of a small hill. By the construction of a retaining wall, which also forms the foundation of the two interior sills, and by projecting the barn forward on the face of the slope, a stable is secured opening on the ground level, and yet sufficiently protected on the north and west to keep it warm in winter. This leaves two faces of the stable foundation exposed, so that a continuous row of windows on the eastern and southern sides gives ample light and ventilation. This method of construction brings the second floor on a level with the ground, and no artificial bridges are necessary to enter the barn. . . .

"The roof is trussed from above so as to leave the storage space in the clear. . . .

"The factory system of exposed structural timbers was followed in the construction of the stable, and the spaces between the supporting timbers are inclosed with matched ceiling and the whole painted white. This gives an attractive appearance and permits the walls to be washed whenever necessary.

"The cow stable is situated in the basement, and is provided with a Portland cement floor, having a sloping surface. . . . The mangers face the exterior walls of the barn."

The construction of the mangers and stalls is the same as in the Wisconsin Station barn (E. S. R., 11, p. 595), except that it has been found necessary for experimental purposes to provide divisions between the mangers.

"This has been cheaply accomplished by cutting out a section of board the shape of the manger, hinging it over the lower angle of the stall division with hoop iron, placing a 2 by 6 scantling at the near side of the manger, and fastening the division firmly by a sliding bolt lock. These partitions are so nicely adjusted that they prevent the admixture of the different cows' feed, and at the same time just sufficient space is left to enable the free movement of water through the entire length of the feeding trough. Their mobility and ease of adjustment is a decided advantage when it becomes necessary to scour the manger. Stalls are provided in the stable for 30 cows.

"The basement also contains a stock-judging room where specimens of the different classes of live stock are brought in and conveniently examined and scored by the agricultural students. . . . Box stalls are provided also in the basement for sick animals and for calves. Closets are conveniently placed for tools and other sundries needed in the stable. The milk room occupies the southeast corner, and is partitioned off from the main stable so that the milk can be immediately removed and kept where there is little danger of its being tainted. This room contains the aerator, milk scale, composite sample jars, tables, and other accessories needed for keeping the various records. The milk is immediately aerated and cooled after being drawn

from the cow, and removed from the building. In the summer time an electric fan is used to cool the milk.

"The feed room is provided . . . with scales and the necessary apparatus. . . .

"There are 3 silos, rectangular in form, with rounded corners, 10 by 18 ft. and 24 ft. high. Their combined capacity is between 250 and 300 tons. The first 10 ft. below the ground is constructed of brick and cement work. Above that point they are built of wood and painted with coal tar. . . .

"On the ground floor [of the barn] ample space is provided for storage. This part of the barn is arranged so that the teams can drive right through and dispose of their loads. . . . A tool room is conveniently located in one corner, and contiguous to this is a storage box for sawdust, which is used for bedding and is carried down to the stable by means of a chute.

"A large experimental seed room is on this floor, which contains the machinery for threshing the grains from the experimental plats, and also space for storing and sorting the same until such times as they may be needed for use. A loft is built above this room so that in case of bad weather the grains harvested from the plats can be drawn in and housed here until threshed. On this floor is located the cutting and grinding machinery, the thresher, and the motor for supplying power. The motor is so placed as to run the grinding and cutting machinery from the same position. The other machinery is driven by means of shafting."

Irrigation (*Tradesman, 44* (*1900*), *No. 2, p. 62*).—This article calls attention to the growing importance of irrigation in the humid region and the need of the enactment of proper laws for the control of the public water supply in the humid as well as in the arid region.

The conquest of arid America, W. E. Smythe (*New York and London: Harper & Bros., 1900, pp. XVI+326, pls. 6, maps 3*).—This book, by the editor of *Irrigation Age*, discusses the history, development, and present status of irrigation in the arid region of the United States from the economic standpoint, and is based upon materials "gathered by ten years of life, work, and study in various parts of the West." The first part of the book deals in a general way with the extent, characteristics, and possibilities under irrigation of the arid region; the second discusses the social and industrial development of the Mormon commonwealth in Utah, the Greeley Colony in Colorado, Southern California, and the irrigated portion of the Great Plains; the third discusses in some detail irrigation development in the several States of the arid region; the fourth treats of such economic questions as the surplus people and the means of colonizing them, and colony plans and institutions—their administration and adaptation to changing conditions. A brief note on methods of irrigation is given as an appendix.

The growth of irrigation in America, E. Mead (*Irrig. Age, 14* (*1900*), *No. 11, pp. 376–385*).

Irrigation in Idaho, W. Fawcett (*Sci. Amer., 83* (*1900*), *No. 10, p. 149, figs. 4*).

Agriculture and irrigation in the Rio Grande Valley, C. W. Kindrick (*Sci. Amer. Sup., 49* (*1900*), *No. 1275, p. 20440*).—A brief note.

Water supply and irrigation in Porto Rico, G. E. Mitchell (*Irrig. Age, 14* (*1900*), *No. 10, pp. 346, 347*).—A brief note.

Irrigation methods in China, G. E. Mitchell (*Irrig. Age, 14* (*1900*), *No. 11, pp. 386, 387*).

Australian irrigation farms (*Sci. Amer. Sup., 50* (*1900*), *No. 1283, pp. 20561, 20562*).—A description of government work in irrigation by artesian wells in New South Wales.

Water measurement and manipulation in Colorado, H. A. Crafts (*Sci. Amer., 83* (*1900*), *No. 6, p. 85, figs. 3*).—A description of methods and results of irrigation in the State.

The maximum duty of water. The extent to which tillage may take the place of irrigation, F. H. King (*Irrig. Age, 14 (1900), No. 4, pp. 127–137*).—A paper read before a farmers' club in Kansas.

An irrigation plant in Provence, E. Farcy (*Jour. Agr. Prat., 1900, II, No. 32, pp. 206, 207, fig. 1*).—A brief description is given of a plant in which water is raised from a stream to a height of 25 meters by means of a turbine and pump, the turbine being driven by water diverted from the stream by means of a barrage. The arrangement of canals, siphons, and reservoirs and the results obtained from irrigation are also noted.

The evolution of farm machines with some suggestions as to their use, G. P. Smith (*Massachusetts State Bd. Agr. Rpt. 1899, pp. 246–257*).—This article discusses improvements made during the nineteenth century in plows, harrows, drills and planters, weeders and cultivators, and mowers and reapers.

A station for testing agricultural implements at Paris, A. de Ceris (*Jour. Agr. Prat., 1900, I, No. 23, pp. 832–834, fig. 1*).—Mainly lists of names of men who have taken part in the work of this station, which was founded in 1889, and of the various machines which have been tested there.

The construction of county roads and bridges, J. C. Nagle (*pp. 14*).—An address prepared for the Good Roads Club of Brazos County, Texas, July 22, 1899.

STATISTICS—MISCELLANEOUS.

Twelfth Annual Report of Louisiana Stations, 1899 (*Louisiana Stas. Rpt. 1899, pp. 16*).—An account is given of the work at the Sugar Station at Audubon Park, the State Station at Baton Rouge, and the North Louisiana Station at Calhoun. The report also contains an outline of the report of the Geological Survey of Louisiana for 1899, notes on the soil survey of the State now in progress, the organization lists of the stations, and a financial statement for the fiscal year ended June 30, 1899.

Annual Report of New Jersey Stations, 1899 (*New Jersey Stas. Rpt. 1899, pp. XIX + 512*).—This includes the organization lists of the stations; financial statement of the State Station for the year ended October 31, 1899, and of the College Station for the fiscal year ended June 30, 1899; a report of the director reviewing the different lines of station work; and reports of the chemists, assistant in horticulture, assistant in dairy husbandry, biologist, botanist, and entomologist containing articles abstracted elsewhere.

Twelfth Annual Report of Tennessee Station, 1899 (*Tennessee Sta. Rpt. 1899, pp. 80*).—This includes the organization list of the station; a report on the staff and general work of the station, with a more detailed outline of the present and proposed work of the agricultural department; a financial statement for the fiscal year ended June 30, 1899; outline of a ten weeks' course in agriculture; a description of a new dairy barn; and miscellaneous articles abstracted elsewhere.

Report of the experiment station at Lyngby, Denmark, for 1898, K. Hansen (*Tidsskr. Landbr. Planteavl, 6 (1900), pp. 57–78*).

Report of the experiment station at Tystofte, Denmark, for 1898, N. P. Nielsen (*Tidsskr. Landbr. Planteavl, 6 (1900), pp. 79–81*).

Report of the experiment station at Askov, Denmark, for 1898, F. Hansen (*Tidsskr. Landbr. Planteavl, 6 (1900), pp. 82–96*).

Report of the experiment station at Vester-Hassing (Knoldgaard), Denmark, for 1898, A. J. Hansen (*Tidsskr. Landbr. Planteavl, 6 (1900), pp. 97–109*).

Crop Reporter (*U. S. Dept. Agr., Crop Reporter Vol. 2, Nos. 1–3, pp. 8 each*).—Beginning with No. 1 of the present volume this publication combines the monthly crop reports and a publication for the exclusive use of crop correspondents previously issued by the Division of Statistics of this Department. In addition to statistical

data on the condition of crops in the different States and Territories in May, June, and July, these numbers contain statistics and popular articles on a variety of subjects, such as New York State canals, agriculture in India, methods for estimating areas of land, sheep grazing on forest reserves, principal crops of Germany for the years 1893–1899, the distribution of the area of production, jute crop of India, the origin of seedless orange culture in the United States, the 1900 wheat crop of British India, and pear blight.

The cotton crop of 1898–99, J. L. WATKINS (*U. S. Dept. Agr., Division of Statistics Bul. 17, misc. ser., pp. 32*).—This contains statistical data on the cotton crop of the different States and Territories as shown by the movement of cotton from the plantation to points of export or consumption and also statistical information on cotton mills in the South and amounts of cotton purchased by them, the Sea Island cotton crop of 1898–99, the value of the cotton crop of 1898–99, comparative acreage and production, the cost of picking cotton, exports of cotton from United States ports, consumption of American cotton by foreign countries, the world's consumption of cotton, cotton acreage since 1894, and cotton crops since 1893. The total cotton crop for the year is estimated at 11,189,205 commercial bales, valued at $305,467,041. Of this the Sea Island crop amounted to 67,791 bales valued at $3,594,245.

The development of the American cotton industry, F. HART (*Jour. Franklin Inst., 150 (1900), No. 3, pp. 161–172*).

Cotton movement and fluctuations 1894 to 1899, LATHAM, ALEXANDER & CO. (*New York: 1899, pp. 151, figs. 6*).

The sugar industry and the manufacture of rum in Porto Rico, E. DELAFOND (*Sucr. Indig., 56 (1900), No. 2, pp. 40–42*).

Sugar industry of Porto Rico, E. DELAFOND (*Internat. Sugar Jour., 2 (1900), No. 20, pp. 432, 433*).—A discussion of the conditions and possible future of the production of cane sugar in Porto Rico.

The peanut-oil industry, R. P. SKINNER (*U. S. Consular Rpts., 63 (1900), No. 236, pp. 82–87*).—The manufacture of peanut oil in France is described and statistics are given concerning the source of the peanuts used for the purpose, their market value, etc.

Agricultural returns for Great Britain for 1899 (*London: Wyman & Sons, 1900, pp. XLVI + 261*).—This report shows the acreage and produce of crops, prices of grain, and number of live stock, with agricultural statistics for the United Kingdom, British possessions, and foreign countries.

Station publications (*Kansas Sta. Bul. 94, pp. 56–67*).—A complete list of station publications is given, those out of print being indicated. The principal subjects treated in the publications are indexed.

Finances—meteorology—index (*Maine Sta. Bul. 58, pp. 8 + 159–171*).—This was published as a part of the Annual Report of the station for 1899 (E. S. R., 12, p. 297).

German Agriculture at the end of the nineteenth century, WERNER and ALBERT (*Arb. Deut. Landw. Gesell., No. 51, pp. 96*).—This is a memoir written on the occasion of the World's Fair at Paris and summarizes the progress of German agriculture during the past 25 years along the following lines: Soil culture; agricultural chemistry; manuring; field crops, including rye, wheat, barley, oats, potatoes, legumes, sugar beets, fodder crops, and commercial crops; stock farming, dealing with horses, cattle, sheep, hogs, and goats; and technical agriculture, such as dairying, sugar-beet manufacture, manufacture of spirits and starch. A final chapter on the agriculture of Germany in the past, present, and future concludes the work.

The development of agricultural instruction in Germany and the seminary for agricultural teachers in the University of Leipsic, G. JOHN (*Fühling's Landw. Ztg., 49 (1900), Nos. 11, pp. 406–411; 12, pp. 445–449; 13, pp. 475–479*;

NOTES.

NEBRASKA STATION.—At a recent meeting of the board of regents, E. Benjamin Andrews, chancellor of the university, was appointed director of the station, and T. L. Lyon, who during the interregnum has been acting director of the station, was appointed associate director.

NEW HAMPSHIRE COLLEGE AND STATION.—Marion Imes, M. S., has been appointed instructor in veterinary medicine and assistant in dairy husbandry. Roscoe H. Shaw, assistant chemist, resigned September 15 to take a position in the Wisconsin University and Station. David B. Bartlett, B. S., has been appointed assistant in bacteriology.

OHIO STATION.—J. C. Burneson, V. S., has been appointed veterinarian of the station.

OKLAHOMA STATION.—At a recent meeting of the board of regents, A. B. McReynolds was appointed assistant in chemistry, *vice* A. G. Ford, resigned.

RHODE ISLAND STATION.—Cooper Curtice has been engaged as biologist, *vice* G. W. Field, resigned. The station has from time to time made exhibits of its products at the county fairs, in connection with the educational exhibits of the college, which have attracted considerable attention. Members of the station staff are preparing timely notes on the work of the station for local agricultural papers, and are making some little effort to visit farms in different sections with a view to getting into closer touch with the farmers and with their needs. There has been an unusual demand for the poultry publications of the station.

TENNESSEE STATION.—The agricultural department has recently prepared a permanent exhibit of the products of the station farm for the past year for the use of the Knoxville Chamber of Commerce, to be sent to the various farmers' meetings in the State to inform them in a graphic way of the lines of work conducted and the progress being made. It consists of twenty-five large, double, oak-framed cases that can be closed and locked and transported readily from place to place. This exhibit was prepared at a cost of about $500, provided by the Knoxville Chamber of Commerce. Already it has done much good and has materially aided in drawing the attention of the farmers toward the station and its work. It has proven the most effective means yet found of demonstrating to the farmers the aid the station can be to them in their work.

TEXAS COLLEGE AND STATION.—J. W. Carson, who for some years was foreman of the farm, has been elected superintendent of the farm. A. M. Ferguson, assistant horticulturist, has resigned to accept the position of assistant botanist in the University of Texas.

UTAH STATION.—Ephraim G. Gowans, M. D., has been appointed biologist of the station, and B. K. Jones, assistant at the Massachusetts station, has been appointed assistant chemist.

VERMONT STATION.—A. W. Edson, A. B., has been appointed assistant botanist.

WISCONSIN UNIVERSITY AND STATION.—F. W. Woll, chemist, has been granted a year's leave of absence, which he will spend in study in Germany.

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EXPERIMENT STATION RECORD.

Editor: E. W. ALLEN, Ph. D., *Assistant Director.*

EDITORIAL DEPARTMENTS.

Chemistry, Dairy Farming, and Dairying—The Editor and H. W. Lawson.
Meteorology, Fertilizers and Soils, (including methods of analysis), and Agricultural Engineering—W. H. Beal.
Botany and Diseases of Plants—Walter H. Evans, Ph. D.
Foods and Animal Production—C. F. Langworthy, Ph. D.
Field Crops—J. I. Schulte.
Entomology and Veterinary Science—E. V. Wilcox, Ph. D.
Horticulture—C. B. Smith and V. A. Clark.
With the cooperation of the scientific divisions of the Department and the Abstract Committee of the Association of Official Agricultural Chemists.

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EXPERIMENT STATION RECORD.

Vol. XII. No. 5.

Much attention has been given during the past year to questions relating to the more perfect organization of the experiment stations. As the stations develop, the importance of a clearer definition of the functions of different officers in administration and investigation becomes more apparent. Conditions which existed when institutions for higher education and research were established in this country have materially changed, and the old forms of organization are now in many cases a serious hindrance to their best development.

The experiment station is by law organized as a department of the college with which it is connected. It differs from the ordinary college department in being charged with the work of investigation, rather than instruction, and in having definite relations with a great industry, for whose promotion it was especially established. Through its correspondence, publications, inspection service, and association with the farming community it has an increasing amount of business not immediately relating to its investigations but requiring special knowledge and skill for its successful discharge. To do most effective work the operations of the station must proceed in accordance with a well-matured plan which involves the cooperation of different members of the staff.

So extensive and important has the business of the stations become that their proper management requires the time and energy of an executive officer, or director. In some cases it may still be possible for the director to conduct investigations in some special line or do a limited amount of teaching, but as a rule he can do little beyond attending to administrative duties. In a number of institutions prudential reasons of various kinds have led to the combination of the offices of president and director. Whatever justification there may have been for this in the past, there is little excuse for it at the present. The duties of the college president are too manifold and onerous to permit his giving much attention to the special needs of an experiment station. His directorship almost necessarily becomes a nominal affair. This arrangement has not worked well, and should be universally abandoned.

As regards the business of the station, the director should be clothed with a large measure of authority and consequent responsibility; should

plan and supervise its work and expenditures, and control its staff to such an extent as will bring them together to work as a unit for the promotion of the station's success. The members of the staff should be directly responsible to the director on all matters relating to the station, whatever their position may be in other departments of the college, and should expect to transact station business through the director rather than through the college president or the governing board. A proper independence in the conduct of investigations, or parts of investigation, in their respective specialties, and just credit for their share in the station's operations as set forth in publications, or otherwise, may, it is believed, be amply secured for the expert officers of the stations at the same time that good discipline is maintained and ample provision made for united effort.

No class of men need to readjust their professional code to the modern requirements of the organization of great scientific and educational enterprises more than college professors and scientific specialists. A way must be found by which teaching and research can be conducted on a system which combines liberty with law. The old régime of the entirely independent teacher and investigator has passed away. The specialization, which is simply a form of the division of labor well-known in industrial pursuits, carries with it a necessity for combination of workers in educational and scientific institutions as well as in manufacturing establishments. In a way hitherto unknown scientific men will be called in the future to work together for common ends.

One of the greatest difficulties in the management of these institutions arises from the fact that while specialization has narrowed the field and outlook of the individual officer, there has not been a corresponding recognition of the necessity of readjusting the form of organization and the spirit of the worker to meet these new conditions. At no time has there been greater need of the cultivation of an earnest and enthusiastic *esprit du corps* among the rank and file of educational and scientific workers. Obviously it should especially be a virtue characteristic of men connected with public institutions. The officers of our agricultural colleges and experiment stations are public functionaries employed to advance very important public interests. With them the good of the community, as involved in the success of the enterprise with which they are connected, should be the ruling motive of action. The fame and emoluments of the individual worker should be subordinated to the requirements of concerted action for a common end. And yet in the long run it is believed the individual worker as well as the institution will profit by a loyal and self-sacrificing discharge of common duties; for union of effort will bring greater success, and whenever a college or a station is strong and flourishing credit is reflected on every worker who has contributed to this issue.

The tide is running strongly toward a more compact organization and a greater unification of the work. On the whole those stations which have a strong organization and administration are meeting with the largest measure of success.

Observation leads to the belief that a widespread differentiation of the investigator from the teacher is gradually taking place. A certain number of men are more and more devoting themselves to the work of investigation and succeeding in it. Others are just as certainly losing their interest and activity in such work. In this as in every other walk of life the personal bent and natural fitness of the man manifests itself as an important element of success which should be reckoned with by those having the administration of our colleges and stations. This differentiation of the investigator from the teacher is not prevented, though it may be hindered, by the double duty which is required of many station and college men, but there is little doubt that in a large majority of cases the requirement of so large an amount of elementary instruction from men who have been appointed upon the station staffs, presumably by reason of their training and fitness for agricultural investigation, is an arrangement which has little if anything but expediency to commend it. From the point of view of the station this expediency is exceedingly doubtful. As Dr. Jordan very truly said in his paper at the last convention of the Association of American Agricultural Colleges and Experiment Stations, "The interests of our stations and, above all, the interests of our agriculture demand that the director and leading members of the staff shall be, first of all, workers for the station, and shall give to its proper activities their highest thought and their best energies. . . . It is entirely out of the question for our college professors to be tied to the insistent daily duties of instructing students and at the same time maintain the close, well-informed, and broadly helpful relation to the needs and conditions of agricultural practice. The experiment station, with an annual income second to no other department in most colleges, should not be in any sense an appendix to class-room instruction, nor was it ever intended that this should be the case. It should have a strong, well-defined, and independent individuality."

Because a man is required to teach many hours he does not thereby become a successful teacher. The research which he is compelled by pressure of college work to carry on during vacations and at night may nevertheless be his real mission. It will be well if boards and presidents will consider more fully the actual state of things, and make, as far as possible, such a readjustment that the investigator will be left very largely to investigate and the teacher to teach.

FOURTEENTH ANNUAL CONVENTION OF THE ASSOCIATION OF AMERICAN AGRICULTURAL COLLEGES AND EXPERIMENT STATIONS.

E. W. ALLEN, Ph. D.

Office of Experiment Stations.

This year being the twenty-fifth anniversary of the establishment of agricultural experiment stations in this country as State institutions, it seemed especially appropriate that the convention of the Association which represents the combined interests of these institutions and the colleges with which they are affiliated should be held in the State where the station movement had its birth. The sessions on November 13 and 15 were held at New Haven, Conn., in the assembly room of the Sheffield Scientific School, and those of November 14, at Middletown in Judd Hall and the chapel of Wesleyan University. The meetings were well attended and the representation was quite general, delegates being present from every section of the country and a considerable number coming from the far West. In all, 116 delegates and visitors registered, representing 38 States and Territories and 68 institutions. The opportunity afforded for looking over the two stations in Connecticut and those in some of the adjoining States was embraced by many of the delegates who came from a distance.

GENERAL SESSIONS.

The general sessions were presided over by President J. E. Stubbs, of the University of Nevada, who delivered the presidential address on the first evening of the convention. This was a scholarly discourse on the subject, What is of most worth in modern education? The answer to this question the speaker conceived to be the exaltation of ethical values, "for the reason that ethical values are fundamental and paramount in the ideas and ideals of modern education—the ideas as representing present methods, organization, and spirit, and the ideals as setting forth the high aims of ceaseless progress toward educational perfection." Modern education seeks the development and the training of those human powers which make for individual worth and social well-being, and he urged the importance of maintaining this union of training for service and of culture for life up to the end of the broadest and most privileged education. He pointed out that "the purpose to be achieved by educators of the present time should be to

make ethical or moral values the guiding and controlling principle in the application of scientific method to education and to the organization of every school, college, or university." Speaking specifically of the duty and obligations of the colleges and universities embraced by the Association, he said: "They are indeed national institutions of learning, and in their plans and systems of study and organization they ought to give preeminence to those subjects which will secure the best results in our national life. If, as has been said, philosophy is the morality of science, and political economy is the morality of industry, commerce and agriculture, and natural law the morality of legislation, and social science the morality of history and politics, then these moralities must be the crowning subjects of education in these national institutions of learning. These represent the liberal element that must pervade all technical courses of instruction. Systematic moral teaching demands a first place."

The report of the executive committee, presented by H. H. Goodell, chairman, mentioned the favorable legislation secured at the last Congress, providing that if at any time the proceeds from the sale of public lands is insufficient to meet the annual appropriations for the land-grant colleges the deficiency shall be paid from any money in the Treasury. A section has been incorporated in a bill now before Congress, making the libraries of all the land-grant colleges depositories of Government publications. Only 25 of these colleges are now designated depositories and their continuance as such is not insured. In this connection, steps have been taken by the executive committee to insure the more prompt delivery of public documents to the designated depositories. In accordance with instructions from the last convention the executive committee secured a place on the programme of the National Educational Association for 1900, in order to present the mission and scope of the land-grant colleges in the American system of education, and the paper was presented by President Beardshear, of Iowa, at the meeting held in Charleston, S. C. The committee called attention to repeated violations of the franking privilege, and recommended "that a codification of the postal regulations be made and sent to each president and director, urging his strict compliance with the law."

President Hadley, of Yale University, addressed the Association briefly, after which a recess was taken to enable members of the Association to meet him.

The report of the treasurer showed that the expenditures during the year had amounted to \$2,019.08, leaving a balance of \$112.97 in the treasury.

The report of the section on horticulture and botany, presented by S. A. Beach, showed that in the work of teaching increased attention is being given to physiological botany. Attention was called to the

growth of nature study and extension work and the recent establishment of a chair of university extension at Cornell University. The work of the station horticulturists as evidenced by their publications was classified, showing that much the largest amount of the printed matter, aggregating nearly one-fourth, related to variety testing, horticultural methods and management ranking second. In reply to the question as to the lines of investigation considered of most importance, the opinions of 44 horticulturists were summarized, bringing out the fact that opinion is at present about equally divided in regard to the importance of plant breeding and variety testing. "There is undoubtedly greater need for variety testing in some sections than in others. In those States where horticultural interests have become well established it is vastly more important to understand more fully the scientific basis of horticultural operations than it is to increase the list of horticultural varieties which are adapted to those sections." Professor Beach referred to the frequent pressure on the horticulturists to do work of a more popular character, and the numerous demands made upon their time and funds for work which is not strictly experimental, showing that in many cases real investigation was practically precluded by the conditions imposed. He urged greater opportunities, in the way of time, funds, and competent assistants, for conducting more scientific investigations in horticulture.

In the report of the section on entomology H. Garman reviewed the present condition of entomological work at the colleges and experiment stations, indicating that much progress is being made in the specialization of the work of entomologists and in the improvement of facilities for research and instruction. About 90 per cent of the colleges and stations now employ entomologists. He noted the growth in recent years in the amount of inspection work required of station entomologists and discussed the best methods of managing this work. It was shown that the inspection of nurseries has led to the exercise of greater care on the part of nurserymen, which has diminished the prevalence of all kinds of injurious insects. The necessity for efficient assistants, especially where inspection work is carried on, was emphasized.

The report of the section on mechanic arts was read by C. S. Murkland. This traced the growth and popularity of the mechanic arts department of the colleges, and pointed out the present relative significance of its courses and the limitations of its work.

The committee on the collective experiment station exhibit at the Paris Exposition made its final report through H. P. Armsby, its chairman. This report described the plan of the exhibit, its preparation and installation, and recommended that the exhibit be kept intact and installed as a permanent exhibit at some place in Washington. The informal report which has been received of the recommendations

made by the class jury indicates a liberal recognition of the merits of the exhibit as a whole, and of its separate parts. No formal notice has been received, however, of the awards as finally made by the superior jury, which passed upon the recommendations of all the juries.

The report of the committee on engineering experiment stations was presented by C. S. Murkland. No attempt had been made to secure Congressional action during the past year and the outlook in that direction was considered less favorable than formerly. The committee accordingly recommended its discontinuance. In adopting this recommendation the Association recorded its judgment that "such stations are demanded by the industrial necessities of the age and should receive favorable consideration by Congress in view of the inestimable benefits that would accrue from them to the people."

The committee on graduate study at Washington made the following recommendations, which were adopted by the Association: "In view of the improbability that the Smithsonian Institution will adopt the suggestions of this Association regarding the organization of a Bureau of Graduate Study, your committee recommends that the Association take no further action in this direction. The committee also believes that for the present further advantage should be taken of the foundation already successfully laid by the Secretary of Agriculture, and it therefore recommends that the Association express its appreciation of the practical efforts which he has made on behalf of this movement, and ask him to consider the practicability of enlarging the present plan for graduate study in that Department, and, if he deems it wise, to invite the cooperation of other departments of the Government, in order that wider opportunities may be open to the graduates of the institutions represented in this Association, as well as of other institutions, to engage in graduate study and research in connection with the work of the National Government."

Dr. Bernard Dyer, of London, England, attended the convention as the representative of the Lawes Agricultural Trust, and delivered a course of three lectures based principally on the investigations, at the Rothamsted Experiment Station, of soils which have been in continuous wheat culture. Samples of the soils from plats which had received different fertilizing materials or none, representing different depths up to 90 in., have been taken at intervals of several years, the last series reported upon being taken in 1893, after being in wheat for 50 years. In all, between 4,000 and 5,000 samples have been studied. Dr. Dyer's lectures dealt with the results of these studies as related to the principal fertilizing ingredients and chlorin in the soils, their availability, migration in the soil and subsoil, leaching, etc. The fallacy of soil analysis without reference to the form or

availability of the constituents was shown very forcibly; for instance, in some cases over a ton of nitrogen per acre was found within the first 9 in. of soil, but the crop showed that it was starving for lack of available nitrogen. As a rule, the Rothamsted soils contain only about 30 to 40 lbs. of nitrogen per acre which is available under the most favorable conditions. Continuous wheat culture was shown to be of necessity an extravagant practice, as the wheat is harvested before nitrification in the soil is completed, and there being no crop to take up the nitrified nitrogen the nitrates are washed out by the rains. The indications are that very little nitrification takes place in the depths of the subsoil, and that these stores of nitrogen are unavailable to plants to any degree. A study of the drainage waters indicates that the ammonia salts rob the soils of lime, rather than the nitrate of soda, as sometimes claimed. Many other interesting points were brought out in regard to the chlorin content of soils, the availability as affected by different fertilizer mixtures, and the effect of other conditions on the rise and fall of the fertilizer elements in the soils. The investigation is one of the most extensive and systematic of its kind, and affords much material for careful study. It is expected that Dr. Dyer's lectures will be published later by the Department.

Besides resolutions of thanks to Dr. Dyer, the Association adopted a memorial expressing its high appreciation of the life and work of the late Sir John Bennet Lawes and his associates at the Rothamsted Station.

A carefully prepared and eloquent address on the career of the late Senator Justin S. Morrill, of Vermont, was delivered by President G. W. Atherton. President Atherton's close association with Senator Morrill for many years and his intimate familiarity with the history of the movement for the establishment of colleges and experiment stations under national auspices enabled him to treat this subject in a very thorough and satisfactory manner, so that his address will have a permanent historical value. By vote of the Association it is to be published separately.

One of the most important subjects on which the Association took action was the report of the committee on cooperative work between the Department of Agriculture and the experiment stations. This was carefully prepared by a representative committee after consultation with the directors of the stations, and was unanimously adopted by the Association. It commended the attitude of the present Secretary of Agriculture towards closer cooperation between the Department and the stations, and pointed out the different ways in which the two institutions might aid each other. It also outlined the principles on which, in the opinion of the committee, the joint work should be arranged and conducted. It was held that both the Department and the stations should feel entirely free to propose or decline cooperative

work; that in undertaking such work the autonomy of the stations should be preserved, and the arrangements made between the stations, as such, and the Department, as such, instead of through individuals; that the cost of cooperation should be borne jointly by the station and the Department; that the results of the investigation should be available to both institutions, priority of publication being a matter of mutual agreement at the outset, and that reasonable mutual assurance should be given of continuance until the work undertaken is completed.

"Your committee deems it very desirable that independent work be not undertaken in the several States by the Department without the knowledge of the station or consultation with the station, particularly along lines of investigation in which the State station is engaged. Whenever cooperation with practical men in the States is desired by the Department in investigations, it is suggested that the State station be the agency through which such cooperation is conducted."

The day spent at Middletown was especially interesting and enjoyable. A general session was held in the chapel of Wesleyan University in the forenoon, at which the delegates were welcomed by President Bradford Raymond, and interesting papers presented by W. H. Jordan on American agricultural experiment stations, and by W. O. Atwater on the History of the Connecticut experiment stations. Lunch was served in the gymnasium, after which the Atwater-Rosa respiration calorimeter was viewed in operation and explained by Professor Atwater and his assistants. Section meetings were held during the afternoon, following which an informal reception was tendered the delegates at Professor Atwater's residence.

In his paper on the American stations Dr. Jordan reviewed the rise and rapid growth of the experiment-station movement in this country, and, after enumerating many of the more important results of the work of the stations, considered their general organization and the relations of station workers to the colleges in the matter of teaching. He pointed out very forcibly the evils resulting to station work from requiring excessive college duties, and urged the necessity for "a station director who is that and nothing more. In the multitudinous duties of administration, in the broad relations which he should sustain with the agriculture of the State, in deciding upon the most useful lines of work, in the sympathetic attitude of encouragement and if possible of inspiration which he should maintain toward his associates, there is abundant opportunity for the full exercise of the largest ability and the most untiring energy. If there is any official in our land-grant colleges other than the president who should not be halved, it is the station director." He then considered the character of work being conducted by the stations, as judged by their publications, deploring the fact brought out that 41 per cent of the pages of the bulletins issued in 1898 and 1899 "had no other purpose than the

diffusion of existing knowledge," and that the preparation of this class of bulletins "appears to be materially increasing, when it ought to be decreasing." He made an earnest plea for greater attention to thorough and conscientious scientific research and investigation, which he held to be the prime object for which the stations were established and in the end the most profitable field of activity.

By vote of the Association Dr. Jordan's paper is to be published separately.

A brief report by the bibliographer, A. C. True, enumerated some of the more important pieces of bibliographical work in lines related to agriculture which have appeared during the past year.

The report from the committee on uniform fertilizer laws, presented by H. J. Wheeler, stated that no attempt had been made to secure national legislation leading to uniform laws, but that several States had taken steps in the direction of greater uniformity, and it was believed that something might yet be done.

The committee on nomenclature made no report, but proposed that the committee be discontinued, which it was voted to do.

The committee on indexing agricultural literature made a report of progress. Additional funds are hoped for to enable the Librarian of the Department of Agriculture to begin the publication of such an index.

The holding of a summer school for graduate students in agriculture was discussed by W. O. Thompson. The idea proposed was an intercollegiate school, the teachers to be drawn from the members of the Association and the sessions to be held at different colleges in succeeding years. The University of Ohio offered to finance the school for the first year, and it was proposed that a canvass be made with a view to holding such a session if there is sufficient encouragement in 1902. The matter was referred to the executive committee for investigation and report.

The committee on revision of the constitution submitted a report, involving some quite radical changes, which was discussed at considerable length. A number of amendments to the constitution were offered during the discussion, involving change of name of the Association, method of nominating officers, etc. The matter was laid upon the table until another year.

The committee on military instruction at land-grant colleges reported that an effort had been made to secure the privilege of graduate study at West Point to officers of college battalions. No definite action has yet been taken.

The committee on methods of teaching agriculture reported progress in completing the syllabi for the three remaining subjects. The committee was continued.

The executive committee was instructed to send a greeting to the

experiment station at Möckern, Germany, on the occasion of the celebration of its fiftieth anniversary.

A resolution offered by W. A. Henry expressing appreciation of the manual on "Agricultural Experiment Stations in the United States," prepared for the Paris Exposition, and requesting a second and enlarged edition, was adopted by the Association.

A committee, consisting of W. M. Hays, T. F. Hunt, A. A. Brigham, L. H. Bailey, and H. P. Armsby, was appointed to confer with the Secretary of Agriculture with reference to holding a conference of persons interested in plant and animal breeding.

The Association endorsed the policy advocated by the Secretary of Agriculture of paying larger salaries to experts in the Department in order to enable the Department to retain their services.

It was voted to reproduce at the Pan-American Exposition at Buffalo the cooperative experiment-station exhibit prepared for the Paris Exposition, "with such withdrawals or additions as may be deemed wise by the Office of Experiment Stations." The executive committee was instructed to take under consideration the appointment of a representative from the Association to act in connection with the dairy exhibit at the Pan-American Exposition.

Resolutions on the death of J. H. Smart and G. E. Morrow, both of whom have until recently taken a prominent part in the Association, were unanimously adopted.

Invitations were received for the Association to meet in Michigan, Mississippi, Maine, and Geneva or Ithaca, N. Y.

The following officers were elected for the ensuing year:

President, A. W. Harris of Maine; vice-presidents, J. K. Patterson of Kentucky, W. H. Jordan of New York, R. H. Jesse of Missouri, L. G. Carpenter of Colorado, and E. A. Bryan of Washington; secretary and treasurer, E. B. Voorhees of New Jersey; bibliographer, A. C. True of Washington, D. C.; executive committee, H. H. Goodell of Massachusetts, Alexis Cope of Ohio, G. W. Atherton of Pennsylvania, and H. C. White of Georgia.

Section on agriculture and chemistry.—Chairman, C. D. Woods, of Maine; secretary, H. J. Waters, of Missouri.

Section on horticulture and botany.—Chairman, L. R. Jones, of Vermont; secretary, W. J. Green, of Ohio.

Section on college work.—Chairman, J. H. Raymond, of West Virginia; secretary, B. O. Aylesworth, of Colorado.

Section on entomology.—Chairman, M. V. Slingerland, of New York; secretary, H. A. Morgan, of Louisiana.

Section on mechanic arts.—Chairman, H. W. Tyler, of Massachusetts; secretary, F. P. Anderson, of Kentucky.

MEETINGS OF SECTIONS.

SECTION ON AGRICULTURE AND CHEMISTRY.

One session of this section was given up to discussions of investigations on tobacco, another to the energy of foods and feeding stuffs, and the third to miscellaneous papers. E. H. Jenkins presented a paper on Methods of experimenting with cigar wrapper leaf tobacco, in which he discussed the conditions which should govern in cooperative experiments, the relations of the station with the experimenter, etc. The station should, if possible, own the land where the experiment is made and always the crop, since the interests of the grower and the experimenter are not the same. All the operations in the field should be in charge of an experienced man, as no general directions can be given in advance. Comparisons should be made only after the fermentation has taken place, that is, in the finished product, and the product should be judged by dealers in the leaf, as the "quality" is subject to the whim of the cigar maker and the trade. Quality was defined as the "fitness to meet the present tastes of the manufacturer of cigars—nothing else." In conclusion, the work of the Connecticut State Station covering a number of years in cooperation with the Connecticut Tobacco Experiment Company and later in cooperation with the Division of Soils of this Department, was reviewed and the methods followed detailed.

The growing and curing of Burley tobacco was described in a paper by M. A. Scovell, the practice of the most intelligent growers in Kentucky and lower Ohio being given. The origin of the White Burley by selection from the Red, and its characteristics and curing were described. It is not fermented and is used mostly in the manufacture of chewing tobacco. It can absorb as high as 40 per cent of its weight in sugar and flavoring extracts, which adapts it to making plug tobacco. "Perhaps the soil has the greatest influence of any one thing in determining the quality of [Burley] tobacco, especially its color," although the season has a marked influence on the quality. There was believed to be a good field for station work in experimenting with fertilizers for Burley tobacco; curing, and selection to get a light leaf.

Milton Whitney described the work of the U. S. Department of Agriculture with tobacco, mentioning briefly the lines of work which have been taken up. In cooperation with the Connecticut State Station Sumatra tobacco has been grown under shade, which, it was stated, experts can not distinguish from the imported leaf.[1] It was believed to be possible on the best tobacco soils to grow Sumatra which will be

[1] The crop has since been sold at an average price of 71 cents per pound, including tops, butts, and trash. As high as $1.25 per pound was received for some of the unsorted product.

equal to the imported article. Work has been taken up with the Pennsylvania filler tobacco, and it is believed that the Cuban type can be approximated in parts of Pennsylvania and more closely in Ohio. The case rot, it was stated, causes a loss of about $1,000,000 annually in Pennsylvania, which can be prevented by proper methods of handling, and this matter is being investigated. A soil survey is being made in Pennsylvania and Ohio in order to determine the tobacco districts with a view to selecting the best kinds to grow. In Florida, where the finest type of cigar leaf tobacco in this country is being produced, the quality varies greatly in adjacent localities. A soil survey will be undertaken there to study this matter. Texas is believed to afford an opportunity to develop the Cuban filler industry. A soil survey will be made there also as a basis for this industry, as the regions especially adapted are supposed to be limited. The tobacco exhibit at the Paris Exposition, which was made under the supervision of the Division of Soils, was described, together with the successful competition of the American grown tobacco with the choice tobaccos of other countries.

A paper, entitled What is available energy, was read by W. O. Atwater, defining this term and describing the means by which this value is determined. The subject was discussed by W. H. Jordan, H. P. Armsby, and C. D. Woods, indicating some confusion in the use of the terms available foods, available energy, actual available energy, etc

A paper by E. B. Voorhees on Cooperative field experiments, outlined the form which the cooperation with farmers should take and the part to be performed by both the station and the farmer. A close supervision over all the separate steps up to the weighing of the final crop was advocated. He cited a number of evidences of the value and utility of cooperative fertilizer experiments in New Jersey. The educational effect on the farmer himself was held to be one of the chief elements of value.

C. S. Phelps described the cooperation between the Connecticut Storrs Station and farmers in testing dairy herds. This work has been in progress for 7 years and has been carried on at 40 separate farms. It was held to be of use to the farmers in improving their rations and to the station in affording a means of testing narrow rations.

In a paper on Our new agricultural industry, I. P. Roberts described the growth of the sugar-beet industry in this country and some lines in which experimental work is still needed.

SECTION ON HORTICULTURE AND BOTANY.

A paper on Plant physiology in its relation to agriculture and horticulture, by A. F. Woods, outlined the requirements of the vegetable physiologist, advocated more thorough training in this subject in

the colleges, and enumerated some of the problems which need investigation.

Laboratory and field work for students in horticulture was discussed by E. S. Goff, who laid much stress on the educational value of work of this character, holding that the student who is to become a horticulturist should be trained in the practical operations of the art.

F. W. Card discussed the Educational status of horticulture, emphasizing the educational value of the study of horticulture, and John Craig described the nature study movement and its workings in New York State.

G. E. Stone presented a paper on The function of the station botanist, the central idea of which was that the function of the station botanist is primarily research, the nature of which must bear intimate relation to agriculture.

The grass and forage plant investigations in the Department of Agriculture and the experiment stations was reviewed by T. A. Williams, especial attention being given to the history of this work in the Department of Agriculture, the lines of work pursued by the Division of Agrostology, and cooperative work with the experiment stations. In conclusion, some of the important results of grass and forage plant investigations were enumerated. The author urged the importance of this line of investigation and pointed out the advantages of cooperation.

Progress of variety testing in experiment station work was the subject of a paper by F. W. Rane. He showed that "while most stations are doing more or less with varieties the general feeling seems to prevail among station workers that after all it is not worth the time and expense necessary." The really new introductions each year were shown to be few, the total number for 1900, as shown by an examination of catalogues of 12 of the largest seedsmen, being 24 varieties of vegetables. The view was expressed that by properly systematizing the work the expense and labor of variety testing might be reduced, and that if properly managed it constituted a legitimate line of horticultural work.

B. D. Halsted showed what the experiment stations have done in originating varieties of plants by crossing and selection, the various lines of activity in this regard at different experiment stations being summarized. Extensive work is in progress in the improvement of corn, cotton, wheat, fruits, vegetables, and other agricultural plants.

The relation of the Section of Seed and Plant Introduction to experiment stations was presented by J. G. Smith, who reviewed the history of the section, the work which it is doing in cooperation with the stations, and some of the more important results. W. E. Britton described a vegetation house arranged for pot experiments.

SECTION ON ENTOMOLOGY.

The attendance of entomologists at this convention was larger than usual and a full programme was presented. W. E. Britton reported experiments on the banding of trees to prevent their injury by the fall cankerworm. Black Virginia oil was found to be better for this purpose than printer's ink.

E. P. Felt presented Suggestions toward greater uniformity in nursery inspection laws and rulings. There was said to be a growing demand for fumigated trees, and the author believed it was better to educate the public rather than to try to enforce laws. Papers on Nursery inspection and orchard insecticide treatment in Illinois, by S. A. Forbes, and Experience in nursery and orchard inspection and some recent results with hydrocyanic-acid gas in large buildings for the destruction of insect pests, by W. G. Johnson, described different phases of this work, and the subject of fumigation was discussed at some length.

Notes on crude petroleum and its effect upon plants and insects were presented by J. B. Smith. When the plants are dormant this may be used even undiluted if the crude oil is pure, but if either gasoline or paraffin has been removed the residue becomes dangerous to the trees. The crude oil should not be used in summer or when the trees are in foliage.

A power sprayer for asparagus was described by F. A. Sirrine. This machine sprays the plants from four directions at once, thus making the treatment very thorough and effective. The same author described a little-known asparagus pest (*Agromyza simplex*) which works in the cambium layer principally, damaging seedling beds more particularly. It is controlled by plucking and burning infested plants.

Other papers read before this section were Entomology in the Southern States, by H. Garman; Danger to American horticulture from the introduction of scale insects, by G. B. King; Observations on *Artace punctistriga*, by H. A. Morgan; and Entomological œcology, by C. W. Woodworth.

SECTION ON COLLEGE WORK.

The only formal paper before this section was one by J. K. Patterson on the General drift of education at the land-grant colleges, the time being occupied by discussion of various subjects.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

The estimation of alumina and ferric oxid in natural phosphates, F. P. Veitch (*Jour. Amer. Chem. Soc., 22 (1900), No. 5, pp. 246–258*).—This article discusses the sources of error in older methods, reports the results of a study of the various factors influencing the accuracy of the determinations, and describes the following method, based upon the results of these experiments:

"Treat 1 gm. of substance in a platinum dish with from 5 to 10 cc. hydrofluoric acid, let stand in the cold from 2 to 3 hours, heat on the water bath to complete dryness, add 2 cc. concentrated sulphuric acid, running well around the sides, and heat at a low temperature until the substance no longer flows in the dish. By this process fluorin is completely expelled. Cool and add from 10 to 20 cc. concentrated hydrochloric acid, and warm a few minutes to soften the mass; transfer to a small beaker, and boil until all aluminum compounds are surely dissolved (15 to 30 minutes); filter from undissolved residue, if any, washing the filter thoroughly, add 50 cc. 25 per cent ammonium chlorid solution and ammonia until alkaline, then hydrochloric acid until the precipitate just dissolves. Cool, dilute to about 250 cc., and add 50 per cent sodium thiosulphate solution, drop by drop, until the solution is colorless, adding in all 20 cc.; cover with a watch glass, boil half an hour, filter, wash back into the same beaker, and dissolve in boiling hydrochloric acid; reprecipitate exactly as before, after adding 2 cc. of a 10 per cent ammonium phosphate solution. Wash 20 times with 5 per cent ammonium nitrate solution, and ignite to constant weight. For the second precipitation ammonium thiosulphate may also be used, but it is not strictly necessary."

A new method for the determination of aluminum, E. T. Allen and V. H. Gottschalk (*Amer. Chem. Jour., 24 (1900), No. 4, pp. 292–304*).—The method proposed is as follows:

"Dissolve the substance in which the aluminum is to be determined in water or a mineral acid. In case the latter is used, nearly neutralize with ammonia. Now dissolve a stick of potash in which the silica, iron, and alumina are known, in a measured quantity of water, and mix thoroughly. One to two grams of potash should be sufficient. Pour the potash solution into a burette, and thence introduce into the aluminum solution a quantity of the former, sufficient to redissolve the precipitate which first forms. If the solution is still turbid no harm is done, but any considerable excess of potash should be avoided. [Soda] may be used as well as potash. Now pass a stream of carbon dioxid into the solution. If the alkali is not in too great excess, precipitation begins in a minute or two. Twenty minutes should suffice to precipitate 0.200 gm. Al_2O_3. The bulk of the alumina comes down in a few minutes, and filtration then proceeds without difficulty. Transfer the precipitate for the most part to a 9 cm. filter and wash several times without suction. The soluble impurities are now mostly removed. Break the paper with a stirring rod, wash back completely

into the original beaker, and boil the precipitate a few minutes with about 150 to 200 cc. water containing a little pure ammonium chlorid or nitrate. The boiling should be continued only 2 or 3 minutes, otherwise the precipitate does not settle well. As soon as it has settled, pass the supernatant liquid through a new filter, using this time a pump and cone. Repeat the boiling and decantation once or twice, transfer the precipitate to the filter, and wash several times with hot water. Suck dry and transfer to a covered crucible, which has been weighed. Dry carefully over the flame, burn the paper, and heat from 5 to 10 minutes at the highest temperature of the blast lamp. Cool from 10 to 15 minutes in a sulphuric acid desiccator, and make an approximate weighing. Heat again for 5 minutes, cool as before, and weigh as directed. From the weight of the precipitate subtract the weight of the impurities in the potash."

A study of the conditions affecting the accuracy of the method is reported.

Estimation of calcium carbonate in soil, H. SCHÜTTE (*Ztschr. Angew. Chem., 1899, p. 854; abs. in Analyst, 25 (1900), May, p. 132*).—It is claimed that the Stutzer and Hartleb method (E. S. R., 11, p. 110) does not give accurate results when applied to some soils, especially those poor in calcium carbonate and containing zeolites. Immendorff's method, carried out as follows, is recommended: Extract the soil with hot hydrochloric acid, make a portion of the solution alkaline with ammonia, warm, clear up with a little acid, and boil. Add a large excess of a strong solution of ammonium oxalate, boil for some time, make alkaline with ammonia, and then faintly acid with acetic acid. Determine the calcium oxalate by titration, or preferably (if the soil contains much iron) collect it on a filter, ignite, and weigh.

Direct estimation of calcium in the presence of iron and aluminum, L. BLUM (*Ztschr. Analyt. Chem., 39 (1900), No. 3, pp. 152–155*).—This method is used in estimating calcium in iron ores and blast-furnace slags. The calcium is precipitated by ammonium oxalate, the iron and aluminum being held in solution by the presence of tartaric acid added to the ammoniacal solution. By this procedure small amounts of oxids of iron, aluminum, and manganese are carried down with the calcium oxalate, but this is said to be very nearly compensated by the calcium that is not precipitated. This is a very short and practical method, but can not be used with substances containing more than 0.5 per cent of manganese.—C. B. WILLIAMS.

Soil humus—some sources of error in analytical methods, A. L. EMERY (*Jour. Amer. Chem. Soc., 22 (1900), No. 5, pp. 285–291*).—Three sources of error are discussed, namely, the expulsion of ammonia from organic matter during leaching with caustic potash, the absorption of ammonia by the humus extract when the soil is leached with ammonia solution, and the loss of organic matter in washing with hydrochloric acid to remove lime. The author proposes to overcome the first difficulty by the following means: "The soil to be leached with caustic potash is placed in a funnel which is closed at the top with a stopper through which the leaching solution is admitted by a separatory funnel.

The glass support of a Gooch crucible serves very well for the funnel holding the soil. The solution from the soil is run directly into dilute sulphuric acid, the bottle containing the same being sealed with a U-tube containing sulphuric acid. Gentle suction can be applied to this apparatus, which greatly hastens the process without the least danger of losing ammonia." For the second and third difficulties no remedy is offered.

The relation of chemistry to the progress of agriculture, H. W. WILEY (*U. S. Dept. Agr. Yearbook 1899, pp. 201–258, pls. 2*). This is a review of agricultural chemistry during the nineteenth century, treating especially of the progress made in the United States. The subject is divided for the purpose of discussion as follows:

"(1) The relation of chemistry to agriculture at the beginning of the century.

"(2) The impetus given to scientific agriculture in its relation to chemistry by the discoveries of Liebig, Gilbert, Boussingault, and other workers, which began to produce effects about the middle of the century.

"(3) A résumé of the relations of chemistry to agriculture up to and at the present time, with a brief reference to the principal methods whereby chemical research has been made useful to practical agriculture."

On a new method of determining aluminum, A. STOCK (*Compt. Rend. Acad. Sci. Paris, 130 (1900), No. 4, pp. 175–178*).—A method based on the separation of iodin and the precipitation of aluminum hydrate when a solution of an aluminum salt is treated with a mixture of potassium iodid and iodate is described.

A process for the determination of carbon dioxid in carbonates, R. E. DEVINE (*Jour. Amer. Chem. Soc., 22 (1900), No. 8, pp. 473–476, fig. 1*).—A description is given of a method based on the principle of Pettenkofer's process, "namely, absorption of the carbon dioxid by a measured amount of standard baryta water (solution of barium hydroxid), and titration of an excess of the latter with a standard acid." The apparatus used by the author in carrying out this method is also described.

Note on the peculiar difficulties which beset the application of the ammonia method to the analysis of sewage and sewage effluents, J. A. WANKLYN (*Chem. News, 81 (1900), No. 2115, pp. 268, 269*).—The results of analyses of a number of samples of sewage effluents are reported which go to show "that no return of the albuminoid ammonia in sewage or sewage effluent is trustworthy unless adequate precautions have been taken to avoid mistaking urea for the complex nitrogenous organic substances which yield albuminoid ammonia."

Apparatus for the determination of ammonia in water by the Wanklyn method and total nitrogen by the Kjeldahl method, R. S. WESTON (*Jour. Amer. Chem. Soc., 22 (1900), No. 8, pp. 468–473, figs. 2*).—The apparatus described is a modification of the Johnson apparatus, improved by Hazen, Clark, and others, adapted to water analysis. The apparatus is so arranged that both the distilling flasks and the receivers are brought to the front and are thus readily accessible to the operator.

A new simple method for the quantitative determination of nitric acid in water, N. N. KOSTJAMIN (*Vrach [St. Petersburg], 21 (1900), p. 728; Pharm. Ztg., 45 (1900), p. 646; abs. in Chem. Ztg., 24 (1900), No. 62, Repert., p. 218; and Chem. Centbl., 1900, II, No. 16, p. 878*).—The method is as follows: Put 5 cc. of the water in a porcelain dish, add slowly (about 2 cc. per minute) and with constant stirring brucin-sulphuric acid (1 part of brucin to 3,000 parts pure sulphuric acid) until the solution shows a uniform clear rose color. The sulphuric acid sets the nitric acid free and this forms, with the brucin, methyl nitrite (CH_3NO_2), kakotelin ($C_{2}H_{22}(NO_2)_2N_2O_5 + H_2O$), and oxalic acid. A table is given from which can be found the N_2O_5 corresponding to the amounts of reagent used.

Estimation of urea in urine, A. Jolles (*Ztschr. Analyt. Chem., 39 (1900), No. 3, pp. 137–145*).

The iodin and bromin values of oils and fats, R. Williams (*Jour. Soc. Chem. Ind., 19 (1900), No. 4, pp. 300, 301*).

Notes on linseed oil analysis, P. C. McIlhiney (*Jour. Soc. Chem. Ind., 19 (1900), No. 4, pp. 320, 321*).

On a new general reaction for albuminoid substances, A. P. Lidof (*Zhur. Russ. Fiz. Khim. Obshch., 31 (1899), p. 781; abs. in Bul. Soc. Chim. Paris, 23 (1900), No. 13, p. 622*).

The composition of the albumin of the seed of the honey locust (Gleditschia triacanthos), M. Goret (*Compt. Rend. Acad. Sci. Paris, 130 (1900), No. 1, pp. 60–63*).

Gypsum and limestone, G. W. Shaw (*Oregon Sta. Bul. 62, pp. 14–17*).—Descriptions and analyses are given of 12 samples of gypsum and 19 samples of limestone, mainly Oregon products.

On an improved absorption apparatus for use in the analysis of essential oils, A. C. Chapman and H. E. Burgess (*Analyst, 25 (1900), Aug., pp. 197–199, fig. 1*).

A platinum crucible for the determination of alkali according to Lawrence Smith, J. Königsberger (*Chem. Ztg., 24 (1900), p. 690; abs. in Chem. Centbl., 1900, II, No. 12, p. 689*).—Instead of the deep crucible ordinarily used, the author employs a crucible of the usual form with a close-fitting cylindrical cover for the fusion of silicates with calcium carbonate and ammonium chlorid in the determination of alkalies according to Smith's method.

An addition to the apparatus used in the estimation of nitrogen by the Kjeldahl method, H. Mehring (*Ztschr. Analyt. Chem., 39 (1900), No. 3, pp. 162, 163*).—Instead of a bulb tube to connect the distilling flask with the condenser, the author uses a wide tube bent twice at obtuse angles in opposite directions, with each end drawn out to make connection. The end connecting with the flask is straight, narrow, and vertical, and in it will form a column of water that will wash the vapor forced through the condenser. The end connected with the condenser is in the shape of a swan's neck. This apparatus is claimed to be durable and efficient.—C. B. WILLIAMS.

Asbestos filters, O. Lohse and P. Thomaschewski (*Ztschr. Analyt. Chem., 39 (1900), No. 3, pp. 158–161*).—To test the value of the Lohse asbestos filter the authors have made many estimations of silver, barium, chlorin, nickel, and sugar (reduction) with closely agreeing results.—C. B. WILLIAMS.

A modification of the Bunsen vacuum pump, M. H. Ittner (*Amer. Chem. Jour., 24 (1900), No. 3, pp. 253–255, fig. 1*).

BOTANY.

Report of the botanist, C. E. Bessey (*Nebraska Sta. Rpt. 1899, pp. 28–34*).—This report contains notes on various plant diseases, poisonous plants, weeds, grasses, forage crops, and the trees of Nebraska. The occurrence of carnation rust is noted, and its prevention by proper management of carnation houses is predicted. A potato disease which produces brown discolorations within the tuber, eventually destroying it, is reported to be rather widespread throughout the State. The author plans to continue his studies on this disease until able to make some definite suggestions regarding its nature and means of eradication. At present it is suggested that in planting no tubers showing any well-marked brown discolorations should be used. Investigations

have been begun on the poisonous plants of the State and a report on the subject will be made later.

Attention is called to the native thistle (*Cnicus undulatus*) and wild morning-glory (*Convolvulus arvensis*). Both of these weeds seem to be spreading, and indications are that unless carefully attended to they will prove troublesome. The Russian thistle, which at one time seemed to threaten the crops of the State, has ceased to be troublesome, and the author states that rarely is a large specimen seen in the vicinity of the station.

The accumulation of asparagin in legumes grown with insufficient light, E. BRÉAL (*Ann. Agron.*, *26* (*1900*), *No. 1*, *pp. 5–19*).—An account is given of some investigations on a number of white, blue, and yellow lupines grown from September until March in a well-heated greenhouse, but which did not receive any direct sunlight after 10 a. m. The plants were grown in water cultures and received no nitrogen, but were given potassium phosphate, potassium chlorid, and magnesium sulphate. The seeds were first washed with corrosive sublimate, germinated between papers, and transferred to the water cultures as soon as their roots were well formed. They made good growth and showed no indication of etiolation.

A large number of plants were examined, the methods being given in detail, and proportionately large increases were noted in their asparagin content. White lupines were found to contain as much as 50 per cent of their dry weight in asparagin, while the seeds contained but 0.6 per cent. Blue lupines analyzed entire contained 37 per cent of asparagin, and other plants kept for 15 days in the dark contained 44 per cent of their dry weight. In April, the sun having ascended, the house was well lighted and plants analyzed after that time showed progressively less asparagin. Experiments with wheat, sunflowers, and gourds showed no accumulation of asparagin. The results obtained with lupines agreed with those of Prianisnikow.[1]

Other experiments are reported in the same article. Lentils deprived of their cotyledons and placed with their roots in starch solutions took up some of the carbohydrates, and some given both starch and mineral matter made better growth than a check lot without starch.

White lupines were made to absorb considerable quantities of potassium humate through tubes containing solutions of the compound being thrust into their stems.

Concerning the pectic matter of plants, A. HÉBERT (*Ann. Agron.*, *26* (*1900*), *No. 1*, *pp. 34–50*).—The author examined the pulp of ripe fruits and the roots of carrots, beets, etc., for pectin, pectose, pectic acids, etc. The principal substances found were pectin and pectic acid. The pectins give viscid solutions in water and are coagulated by the addition of alkalis. When treated with potash they give pectic acid.

[1] Landw. Vers. Stat., 52 (1899), No. 1–2, p. 137–164.

The ferment pectase acting upon pectin also gives pectic acid. By hydrolysis the pectic bodies yield pectoses, and especially arabinose. By oxidation they yield mucic acid. From this it is concluded that pentosan and galactan are present in the molecule of pectic bodies.

It is claimed that the investigations of the author, as well as all recent work, indicate that the pectic bodies are formed by the chlorophyll of the plant.

On the hybrid fecundation of the endosperm of maize, H. DE VRIES (*Rev. Gén. Bot., 12 (1900), No. 136, pp. 129–137, pl. 1*).—A review of some of the literature bearing upon the immediate effect of pollen, or xenia as it has been called, is given, together with an account of the author's experiments with maize. The experiments are fully discussed and the conclusion reached that the effect commonly noted as the result of crossing different races or varieties of maize is due to double fecundation. Wherever a grain of corn shows the characteristics of the male parent in the endosperm it is the result of hybrid fecundation. Where the characteristics of the female parent are exhibited it is a case of self-fertilization. The explanation of these phenomena is to be found in the discovery of double fecundation by Nawaschin and Guignard.

Progress of plant breeding in the United States, H. J. WEBBER and E. A. BESSEY (*U. S. Dept. Agr. Yearbook 1899, pp. 465–490, pls. 3, figs. 2*).—The early horticultural and agricultural conditions of the United States are described, together with early methods of plant breeding. The improvements effected during the past century are mentioned more or less in detail, being grouped under the different headings of fruits, berries, vegetables, cereals, ornamentals, nuts, cotton, etc.

Progress of economic and scientific agrostology, F. LAMSON-SCRIBNER (*U. S. Dept. Agr. Yearbook 1899, pp. 347–366, figs. 5*).—The early investigations relating to grass and forage plants are briefly described, together with a description of the establishment and work of the Division of Agrostology of this Department. The grass investigations which have been conducted in different parts of the country are outlined and descriptions given of some of the more valuable grasses and forage plants.

Economic grasses, F. LAMSON-SCRIBNER (*U. S. Dept. Agr., Division of Agrostology Bul. 14, rev., pp. 85, pls. 3, figs. 91*).—This bulletin, which is a revised edition of a previous one (E. S. R., 10, p. 718), contains much of the economic information given in Bulletin 3 of this Division (E. S. R., 8, p. 687).

Seedling forms of New Zealand phanerogams and their development, L. COCKAYNE (*Trans. and Proc. New Zealand Inst., 31 (1898), pp. 354–398, pls. 5*).—A biological study of a large number of seedling forms of New Zealand plants.

The mistletoe, J. HUBERTY (*Bul. Soc. Cent. Forst. Belg., 7 (1900), Nos. 4, pp. 284–290; 5, pp. 373–381; 6, pp. 443–451*).—The life history of the mistletoe is reviewed at considerable length, and its method of attacking the host and the effect, as shown by analyses of the wood of infested and sound trees, is described. Various means of destroying mistletoe are suggested, among which the cutting away of the branches is probably the most efficient.

Photometric investigations in vegetable physiology, WIESNER (*Bot. Centbl., 82 (1900), No. 10–11, pp. 316–318*).—A summary is presented of the author's investigations on the various adaptations of plants to light in the arctic regions.

Formation of oil in the olive, G. SPAMPANI (*Bul. Soc. Bot. Ital., 1899, pp. 139–143; abs. in Jour. Roy. Micros. Soc. [London], 1900, No. 3, pp. 342, 343*).—A

description is given of the mode of formation of oil in the fruit of the olive. This takes place in the cells of the epicarp, especially in those of the mesocarp. The oil is not transferred to the cells where it is ultimately found, but is formed in them. In the case of the olive there is a marked illustration of the almost universal phenomenon of the presence of oily substances in the active protoplasm. This oil is not the result of the degeneration of the protoplasm, but is formed when that substance is in its most active condition.

Anatomical studies of important fiber plants of Japan with special reference to their bast fibers, K. SAITO (*Bot. Centbl., 83* (*1900*), *No. 11, p. 351*).

The latex system of lacquer trees and related species, T. INUI (*Bot. Centbl., 83* (*1900*), *No. 11, p. 352*).—The endemic species of Rhus were examined and a laticiferous system found in all but *R. radicans*. The method of secretion of latex and effect of external factors upon its production are briefly shown.

On the selective power of root tubercle bacteria, L. HILTNER (*Centbl. Bakt. u. Par., 2. Abt., 6* (*1900*), *No. 9, pp. 273–281*).—Replying to a recent article by Stutzer, the author maintains that within certain limits the presence of bacteroids depends upon the host as well as upon the kind of bacteria in the soil or medium.

Nitrogenous constituents of fungi, E. WINTERSTEIN (*Bot. Centbl. Beihefte, 9* (*1900*), *p. 167; abs. in Jour. Roy. Micros. Soc.* [*London*], *1900, No. 3, p. 362*).—The chemical composition of fungi is said to differ in several important points from that of flowering plants. In addition to carbohydrates, the membranes contain a nitrogenous substance, chitin. In neither fresh nor dry specimens of *Boletus edulis*, *Cantherellus cibarius*, or *Agaricus campestris* was the author able to isolate proteids. From *B. edulis* and *A. campestris* leucin was crystallized and the presence of tyrosin demonstrated by Millon's reagent.

The influence of inorganic salts on the formation of conidia in Aspergillus niger, A. YASUDA (*Bot. Mag.* [*Tokyo*], *13* (*1899*), *p. 85; abs. in Jour. Roy. Micros. Soc.* [*London*], *1900, No. 3, p. 364*).—As the result of a series of experiments it was found that the formation of conidia is retarded in proportion to the concentration of the nutrient fluid. The size of the conidia also decreases under the same condition. The conidia bearing hyphæ become shorter, and the black color of the conidia is greatly increased. When solutions are very concentrated, the formation ceases entirely.

Fungi in juniper berries, A. NESTLER (*Ber. Deut. Bot. Gesell., 17* (*1899*), *pp. 320–325, pl. 1; abs. in Jour. Roy. Micros. Soc.* [*London*], *1900, No. 3, p. 365*).—It is stated that the mycelium of a fungus is almost universally present in the so-called berries of the juniper in the second year after their formation. Experiments on infection seem to show that the change of color from green to black or blue black is due to the action of the fungus. The exact nature of the fungus has not been determined, but the incipient forms of spores resembling those of Aspergillus were observed. It is thought probable that there is more than one species of the fungus.

Investigations on the morphology of the stroma-forming Sphæriales, W. RUHLAND (*Sep. Hedwigia, 39* (*1900*), *pp. 79, pls. 3*).

ZOOLOGY.

Revision of American voles of the genus Microtus, V. BAILEY (*U. S. Dept. Agr., Division of Biological Survey, North American Fauna 17, pp. 88, pls. 5, figs. 17*).—This bulletin contains an account of the habits, food plants, economic status, and injuriousness of the voles, or meadow mice, together with brief notes on methods of preventing injury by these animals. It is recommended that wire net-

ting, tent cylinders, burlap, twisted ropes of straw, or other substances be wrapped around trees in winter to prevent injury to the bark by voles. No direct remedy against these animals is suggested, but it is urged that means be taken to protect owls, hawks, and other animals which feed upon voles. The greater part of the bulletin is occupied with a systematic account of the species of the genus Microtus. Seventy species and subspecies are recognized, being distributed in 8 subgenera.

Zoological yearbook for 1899, P. MAYER (*Zoologischer Jahresbericht für 1899. Berlin: R. Friedländer & Son, 1900, pp. 489*).—This volume contains detailed lists of literature upon the following groups of animals: Protozoa, Porifera, Cœlenterata, Echinodermata, Vermes, Bryozoa and Brachiopoda, Arthropoda, Mollusca, Tunicata, and Vertebrata.

Cyanid of potassium for poisoning rabbits (*Jour. Agr. and Ind. South Australia, 3 (1900), No. 7, pp. 566–568*).—About half an acre of land was inclosed by means of wire netting in order to prevent rabbits from going to natural water sources. Water which had been poisoned with cyanid of potash in the ratio of 1 : 1,000 was then exposed in shallow tin vessels during the night. In the morning it was found that about 1 gal. of water had been taken by the rabbits and 11 dead rabbits were found. On the second morning 77 rabbits were found dead, the majority being fully grown. The method is believed to be effective for the destruction of rabbits.

Rodents, O. LUGGER (*Farm Students' Rev., 5 (1900), No. 21, pp. 17–19, figs. 3*).—Popular notes on rabbits and other rodents as related to agriculture.

A review of economic ornithology in the United States, T. S. PALMER (*U. S. Dept. Agr. Yearbook 1899, pp. 259–292, pls. 3*).—The author briefly reviews the investigations in the different States and in this Department upon the economic relations of various birds. An account is also given of the extent to which game birds are used, the collection of birds' eggs for food, the use of feathers and guano, measures for the destruction of injurious birds, preservation of beneficial birds, and the introduction of birds.

How some birds help the farmer, V. H. LOWE (*Trans. New York State Agr. Soc. and New York Bureau Farmers' Inst. Rpt. 1898, pp. 315–326, pls. 5*).—Notes on the economic relationship of the crow, blackbird, robin, Baltimore oriole, meadow lark, downy woodpecker, hairy woodpecker, brown creeper, chickadee, native sparrows, and cuckoos, with a short bibliography.

Some of the economic relations of birds and their food, F. E. L. BEAL (*Proc. New Jersey State Hort. Soc. 1899, pp. 104–129*).—This article presents a general discussion of the agency of birds in controlling the multiplication of certain injurious insects. The particular food habits of a number of birds are described, together with an account of those families of insects which contribute most extensively to the food of birds.

Birds, ANNIE M. GRANT (*Rhode Island State Bd. Agr. Rpt. 1898, pp. 50–82, figs. 11*).—This paper is a popular discussion of the benefits conferred upon agriculture and horticulture by birds, with suggestions of measures for protection and preservation of birds.

Our native birds, D. LANGE (*New York: Macmillan Co., 1899, pp. 162, figs. 10*).—A discussion of the causes of the decrease in the number of birds and methods for protecting them.

How to encourage the nesting of insectivorous birds in fruit orchards, SCHWARZ (*Hessische Landw. Ztschr., 69 (1900), No. 1, pp. 6, 7, fig. 1*).—A description with illustration of a box for feeding such birds during the winter season.

A list of the insectivorous birds of New South Wales, A. J. NORTH (*Agr. Gaz.

New South Wales, 11 (1900), No. 1, pp. 1, 2, pl. 1).—Notes on the habits of species of Struthidea and Pomatostomus.

An attempt to protect the green woodpecker, C. SARCÉ (*Belg. Hort. et Agr., 12 (1900), No. 3, pp. 42, 43*).—Notes on the insectivorous habits of this bird.

Investigations on the stomach contents of the seed crow (Corvus frugilegus), M. HOLLRUNG (*Jahresber. Vers. Stat. Pflanzenschutz, Halle, 10 (1898), pp. 11–28*).—A detailed statement is made of the stomach contents of 324 seed crows, 11 hooded crows, and 5 jackdaws. The majority of these birds were killed during the summer season, but the conclusions to be drawn from a study of the stomach contents are favorable for the birds.

Oysters and disease, W. A. HERDMAN and R. BOYCE (*London: G. Phillips & Son, 1899, pp. 60, pls. 8; abs. in British Med. Jour., 1900, No. 2041, p. 338*).—In this article the authors discuss, among other matters, the greening of oysters. The conclusion is reached that there are several distinct varieties of this phenomena. Some, like the green oysters of certain rivers of the Essex coast, are healthy, while others, such as Falmouth oysters, contain copper.

Eel worm in roses, B. D. HALSTED (*Florists' Exchange, 12 (1900), No. 4, pp. 84, 85, fig. 1*).—Brief notes on these worms, with the recommendation to heat the soil to 140° F. before planting.

Earthworms in the forest, E. HENRY (*Bul. Soc. Sci. Nancy, 3. ser., 1 (1900), No. 2, pp. 23–34*).—This article contains a brief historical account of the literature relating to the effect of earthworms upon the condition of the soil, and also brief observations upon their habits in the soil of forests. Notes are given on the action of earthworms in burying the various forest leaves and upon the apparent choice of kinds of leaves by the worms.

METEOROLOGY—CLIMATOLOGY.

Nile floods and monsoon rains (*Nature, 62 (1900), No. 1608, pp. 391, 392*).—This article discusses, on the basis of data furnished by the meteorological reporter to the government of India, the relation between the amount of the Nile floods and the abundance or deficiency of the southwest monsoon rainfall in India. The relationship was first suggested by Willcocks in a paper before the Meteorological Congress at the World's Fair in Chicago (E. S. R., 5, p. 1086). It is claimed that the observations which have been made "indicate that in at least four out of five seasons in which there was a partial failure of the rains in India there was a low Nile, and that generally the two countries are similarly affected by the meteorological conditions and the variations of those conditions. The causes of these variations are obscure and at present very imperfectly recognized."

Work of the meteorologist for the benefit of agriculture, commerce, and navigation, F. H. BIGELOW (*U. S. Dept. Agr. Yearbook 1899, pp. 71–92, pls. 2*).—This paper is devoted mainly to a history of the U. S. Weather Bureau and an account of its working, it being stated that "a consideration of the development of meteorological science in the United States, especially in its practical application to agriculture, commerce, and navigation, involves mainly a review of the United States Weather Bureau and its work." The topics treated include The organic laws establishing the weather service, the three epochs of meteorological service, a preliminary historical sketch of meteorology in the United States, the weather map, administration of the weather service, meteorological reports and storm warnings, instruction

in meteorology, means of instruction and information for the public, contributions of the Weather Bureau to meteorology, and latest views on the theories of the origin of storms.

Recent progress in weather forecasting, P. Holdefleiss (*Fühling's Landw. Ztg., 49 (1900), No. 7, pp. 270–273*).—This is a brief review of a paper by W. J. van Bebber on The scientific basis for forecasting the weather several days in advance, published at Hamburg in 1899.

Anemometer tests, C. F. Marvin (*U. S. Dept. Agr., Weather Bureau Doc. 223, pp. 18, pls. 2, figs. 5*).—This paper, which is reprinted from the *Monthly Weather Review, 28 (1900), No. 2* (E. S. R., 12, p. 119), "aims to give briefly the results of a limited series of experiments recently conducted by the writer to determine the law of action of a small anemometer employed on kites to record the motion of the wind in the free air. . . . The general question of anemometer testing is also very briefly discussed."

Meteorological tables, T. S. Outram (*Minnesota Sta. Rpt. 1899, pp. 575–587*).—These tables give the monthly and annual mean temperature and precipitation for the year 1898 and 6 months of 1899, with departures from the normal for 62 stations in the State.

Meteorological observations, C. W. Peterson (*Rpt. Dept. Agr. Northwest Territories, 1899, pp. 5–14*).—Tabular statements are given of (1) the total annual precipitation from 1883 to 1899, inclusive, at 8 stations; (2) total monthly precipitation during 1899 at 39 stations; and (3) the maximum, minimum, and mean temperature during each month of 1899 at 34 stations. "A brief summary of the records of the Dominion meteorological service of the temperature and precipitation conditions prevailing throughout the Northwest Territories during each month of the year" is also given. The meteorological stations (with voluntary observers) in the Territories now number 44.

General summary of meteorological observations in Mexico during 1899, E. E. Schulz (*Rev. Cient. Bol. Met., 3 (1900), No. 1–2, pp. 145–158*).

Contribution to the study of the climatology of the Valley of Mexico, M. Moreno y Anda (*Mem. y Rev. Soc. Cient. "Antonio Alzate," 14 (1899–1900), No. 9–10, pp. 353–360*).—This is a summary of observations on barometric pressure during 15 years (1884–1898) at the Tacubaya Observatory.

AIR—WATER—SOILS.

A study of soil moisture, C. A. Keffer and J. D. Tinsley (*New Mexico Sta. Bul. 31, pp. 16, fig. 1*).—Incomplete records of moisture at depths of 6 to 9 in. and 21 to 24 in. in the soil of plats planted to corn and cultivated in different ways during the season beginning April 17 and ending October 5, 1899, are reported and discussed. The moisture determinations were made by the gravimetric method and by means of the electrical apparatus devised by the Division of Soils of this Department. Practically all types of soil texture, from adobe to pure sand, were represented in the plats used in this experiment. Consequently a great variation in the moisture content and requirements of the soils was observed. While the results are incomplete and not conclusive they indicate "the great variability in the character and moisture content of the alluvial soils of the Rio Grande valley."

"[They also indicate] the importance of maintaining a sufficient moisture supply for the continuous, uninterrupted growth of the crop—the great quantity of poorly developed corn in this field being assumed to be due to the check in the growth of the second planting, caused by drought; and of bringing all parts of a field to as nearly the same moisture holding capacity as possible by the application of correctives, preferably in the form of green crops, to be plowed under during active growth."

Soil moisture, H. H. NICHOLSON (*Nebraska Sta. Rpt. 1899, pp. 35–37*).—A brief account is given of a study of methods of determining the moisture content of soils, especial attention being called to errors in sampling. An apparatus devised for taking soil samples at different depths is described as follows:

"[It] consists of a 2 in. brass tube 24 in. long. In the side, 4 in. back from the cutting edge, a section is cut out and then fastened to the tube by a hinge joint. This pocket cover is held in place by a sleeve which screws down against a shoulder just above the cutting edge. To obtain a sample at a depth of 9 to 12 in., for example, the tube is driven down 12 in. into the soil and then withdrawn. The core of soil remains in the tube. The sleeve is unscrewed and slipped back and the cover raised. Three inches of the cylinder of soil thus exposed is cut out with a spatula and dropped into a tared box and weighed and dried. Results obtained thus far are highly encouraging."

The chemical and geological history of the atmosphere, J. STEVENSON (*Phil. Mag. and Jour. Sci., 5. ser., 50 (1900), Nos. 304, pp. 312–323; 305, pp. 399–407*).—This paper discusses "the question as to whether any notable change has taken place in the chemical composition of the atmosphere in the course of geological history." The author adduces evidence derived mainly from a study of the amount of carbonaceous and other oxidizable matter due to vegetation which is found on the earth to prove "that there was a time when there was no free oxygen on the earth."

Movements of ground water, B. S. LYMAN (*Jour. Franklin Inst., 150 (1900), No. 4, pp. 285–299*).—A critical review of reports on the principles and conditions of the movements of ground water, by F. H. King and C. H. Schlichter, which have already been noted (E. S. R., 11, pp. 517, 519).

Artesian wells, L. WOOLMAN (*Rpt. State Geologist of New Jersey, 1899, pp. 55–139*).—A record is given of size, depth, character of strata penetrated, quality of water supplied, etc., of 98 artesian wells, mainly in New Jersey, but including some in other States.

The influence of forests on soil moisture, drainage, and ground water, and the flow of springs, E. W. EBERMAYER (*Einfluss der Wälder auf die Bodenfeuchtigkeit, auf das Sickerwasser, auf das Grundwasser, und auf die Ergiebigkeit der Quellen. Stuttgart: Ferdinand Enke, 1900, pp. 51*).

Chlorin in the natural waters of the State, W. S. MYERS (*Rpt. State Geologist of New Jersey, 1899, pp. 141–148*).—Determinations of total solids and chlorin in 39 samples and detailed sanitary analyses of 18 samples of surface waters are reported. This data is being collected with a view to preparing a map showing the normal chlorin content of the potable waters of each locality in New Jersey.

The question of the hygienic importance of nitrites in drinking water, E. SCHAER (*Ber. Deut. Chem. Gesell., 33 (1900), No. 8, pp. 1232–1236*).—The author agrees with Spiegel (E. S. R., 12, p. 21) that in the present state of our knowledge the determination of nitrites in water is neither positively nor negatively of decisive importance.

Soil investigations in the United States, M. WHITNEY (*U. S. Dept. Agr. Yearbook 1899, pp. 335–346*).—This article discusses the influence of transportation facilities

on population and farm crops, early use of fertilizers, chemical investigation of soils, bacteriological investigation of soils, physical conditions and soil investigations, and important soil investigations and their utility. It is a review of progress in this line of investigation during the nineteenth century.

"Probably the most important immediate results of practical utility to be derived from these soil investigations are the mapping of large areas in important agricultural districts. In the irrigation districts these investigations point out any source of alkali which is to be feared, the cause of the accumulation, and give a basis for the intelligent underdrainage when necessary to remove the salts and seepage waters. In all cases the maps show the various types of soils, and the reports accompanying them explain the differences in these soils so far as possible, and describe their characteristics. The greatest value of these maps will be in the possibility of intelligent specialization. When a light loam is seen adjoining a heavier loam or clay the methods of cultivation or cropping should not be alike, and will not be when the farmers realize the importance of the differences in the properties of the soils. It is generally a waste of energy to attempt thus to compete, or use the same methods, or even to grow the same crops oftentime on soils of such different texture. The safest and altogether most practical thing is to recognize the differences in the soils and the peculiarities of each; use each for the particular crop or class of crops best suited to the conditions; then attempt to improve each by the controlling factors, which are quite sure to be revealed in the experience of changing climatic conditions and the development of crops in the course of 2 or 3 years. The development of plants is a sure and safe guide generally to an experienced person as to the condition of the soil. This specialization is unquestionably developing in this country as a result of competition and of social conditions, and reliable and detailed soil maps will be the best possible basis for this purpose."

On marsh formation on the west coast of Schleswig and on the character of the reclaimed lands, BECKER (*Jour. Landw., 48 (1900), No. 2, pp. 123–145, figs. 2*).—The formation and character of these lands are described and physical and chemical analyses and pot tests of samples of the soil are reported.

Dunes and their culture (*Deut. Landw. Presse, 27 (1900), Nos. 40, pp. 499, 500, figs. 4; 44, p. 551, figs. 3*).

FERTILIZERS.

Alfalfa as a fertilizer, B. C. BUFFUM (*Wyoming Sta. Bul. 44, pp. 93–106, pls. 2*).—This bulletin discusses briefly the fertilizer requirements of soils of arid regions, especially of Wyoming, and the value of alfalfa for increasing the nitrogen of the soil, improving the tilth, and destroying weeds; and gives the history of an acre plat on the Laramie Plains, one-half of which had been in alfalfa since 1893 and the other half in other crops. The whole plat was plowed in the fall of 1898 and seeded in the spring of 1899 to wheat, oats, and potatoes, one-half of each of these crops being on the alfalfa land and the other half on the part which had been under rotation with other crops. The main results obtained are summarized as follows:

"The value of alfalfa harvested from one-half acre of land for 5 years at Laramie was about $50 more than the cost of producing it.

"The value of potatoes and grain from an adjoining half acre for 5 years was about $44 more than the cost of producing at local prices.

"When the alfalfa land was plowed and planted to wheat it produced $8 to $12 more value in wheat per acre than the land which had grown potatoes and grain before.

"When alfalfa land was plowed and planted to oats it produced $16 worth of grain more than land which had grown potatoes and grain before.

"When alfalfa land was plowed and planted to potatoes it gave $16 worth more of potatoes per acre than was obtained from land which had grown potatoes and grain before.

"By growing alfalfa the above increase of yields and values were produced with absolutely no cost for fertilizing the land."

Nitrate of soda and sulphate of ammonia on marsh soils, CLAUSEN (*Landw. Wchnbl. Schleswig-Holstein, 50 (1900), No. 33, pp. 562–564, fig. 1*). Pot experiments with a soil containing 5 to 7 per cent of fine sand, 25 per cent of clay, and 2.5 per cent of calcium carbonate are briefly reported. The pots contained 5.5 kg. of soil. Oats was the crop grown. Nitrate of soda was applied May 26 at the rate of 1.3 gm. per pot, sulphate of ammonia May 9 and 10 at the rate of 1 gm. per pot. Similar experiments were made with beets in pots containing 16 kg. of soil. The superiority of the sulphate was evident during the growing period, and the yields of both oats and beets were decidedly larger on the pots receiving sulphate. These results indicate that on marsh soils containing a liberal supply of lime, sulphate of ammonia may with advantage be substituted for nitrate of soda, and confirm the wisdom of the practice common in Germany of using ammoniated superphosphates on such soils.

The basic constituents of crops, R. WARINGTON and E. DEMOUSSY (*Ann. Agron., 26 (1900), No. 5, pp. 246–257*).—This is a translation and discussion by E. Demoussy of an article by R. Warington.[1]

In this article the author attempts to show the relation between salifiable bases in the ash of plants and their nitrogen content, assuming that "if the whole of the nitrogen in a crop has been derived from nitrates and no subsequent loss of the bases of these nitrates has occurred we ought to find in the plant ash an amount of salifiable base equivalent to the nitrogen content in the crop." Applying this theory to a number of different crops it was found that the salifiable base actually present, as shown by average analyses, varied from 20 per cent to 92 per cent of the assumed nitrate base. Further investigation of this subject by means of pot experiments and analyses of more carefully selected material is suggested.

Change in weight of some artificial fertilizers on exposure to the air, L. VON WISSELL (*Jour. Landw., 48 (1900), No. 2, pp. 116–121*). Fifty gram lots of Thomas slag, superphosphate, kainit, nitrate of soda, and ammonium sulphate were exposed to the air in the open and in a laboratory in flat porcelain dishes during different seasons of the year. The dishes were covered with perforated filter paper and were weighed almost daily (with the paper covers removed). There was a small increase in weight of the Thomas slag after a few days'

[1] Agr. Students' Gaz., n. ser., 9 (1899), pp. 133–138.

exposure to the air, the weight remaining constant thereafter. The superphosphate increased or decreased in weight according to the temperature and the moisture of the air. Kainit was the most hygroscopic of the materials tested. In one instance its weight increased 31 per cent in 8 days. The weight of the nitrate of soda fluctuated with the temperature and moisture content of the air. In hot, dry weather it lost nearly all of its water, while in one case in damp weather it increased in weight 11 per cent. In case of ammonium sulphate the increase in weight was not very large.

Analyses of commercial fertilizers, J. L. Hills, C. H. Jones, and B. O. White (*Vermont Sta. Bul. 80, pp. 201–245*).—This bulletin discusses the valuation and selling price of fertilizers, the usefulness of a fertilizer control, guaranties and brand names, sources from which plant food is derived, availability of organic nitrogen, and the selection and purchase of fertilizers; and reports analyses of 132 brands, representing 19 companies. This includes 86 analyses reported in previous bulletins of the station (E. S. R., 12, pp. 226, 430). "Six-sevenths of the brands were up to or above guaranty, one-seventh fell short somewhat, and one-twentieth failed to furnish a commercial equivalent of their guaranties." While as a rule the quality of materials used in fertilizers was good, it was found that two-fifths of the brands contained no water-soluble nitrogen, and that sulphate of potash was found in but one-seventh of the brands examined, although claimed to be present in three-fourths. The average selling price of the fertilizers examined approximated $28.73, the average valuation $18.08. The average composition of the fertilizers was but slightly higher than last year. "Plant food is as cheap as it ever was; yet buying mixed goods on time is still a more costly method of getting plant food than is home mixing or buying on special order." A table compares the analyses of 133 brands for 5 years.

Fertilizer experiments on the action of Thomas slag and nitrate of soda as supplements to barnyard manure (*Fühling's Landw. Ztg., 49 (1900), No. 7, pp. 265–270, fig. 1*).—Experiments with fodder beets, turnips, and cabbages on light marsh soil are reported. A decided benefit resulted from the addition of the phosphoric acid to the manure, but there was no evidence that the supplementary application of nitrate of soda was of any benefit except during the earlier stages of growth when the supply of available nitrogen in the soil was small.

Nitrate of soda or ammonia? P. Wagner (*Hessische Landw. Ztschr., 70 (1900), No. 8, pp. 91–93*).—A popular discussion of the relative fertilizing value of these two substances.

On phosphates, L. Schucht (*Ztschr. Angew. Chem., 1900, Nos. 20, pp. 489–491; 21, pp. 512–515*).—Discusses the occurrence, composition, and properties of the principal phosphates of the world.

Transformation of phosphates and potash salts in the soil, L. Grandeau (*Jour. Agr. Prat., 1900, I, No. 18, pp. 633, 634*).—This is a brief note on tables and charts prepared for the exposition at Paris, showing the manuring, culture, and yields in field experiments carried on by the experiment station of Est since 1892.

Attention is especially called to the total phosphoric acid and potash and that soluble in 1 per cent citric acid in the soils of the differently fertilized plats.

Analyses of commercial fertilizers, M. B. HARDIN (*South Carolina Bul. 53, pp. 24*).—This bulletin reports analyses of 176 samples of fertilizers collected during the season of 1899–1900, discusses the composition and valuation of commercial fertilizers, and gives regulations governing the sale of fertilizers in South Carolina and the text of the law providing for the free analysis of purchasers' samples of fertilizers, recently passed by the State legislature.

Analyses of commercial fertilizers, J. L. HILLS, C. H. JONES, and B. O. WHITE (*Vermont Sta. Bul. 79, pp. 189–198*).—The results of analyses of 47 brands of fertilizers, representing 17 manufacturers, are reported.

Commercial fertilizers, J. H. STEWART and B. H. HITE (*West Virginia Sta. Bul. 65, pp. 181–196*).—This bulletin gives analyses and valuations of 140 samples of fertilizers registered for sale in West Virginia from January 1 to April 15, 1900, with a schedule of trade values of fertilizing materials, and the text of the State law relating to fertilizers.

FIELD CROPS.

Report of the agriculturist, T. L. LYON (*Nebraska Sta. Rpt. 1899, pp. 15–22*).—Brief summary of results obtained in soil tillage and cultivation experiments, in tests with barnyard manure and other fertilizers, and with sugar beets, grasses, forage crops, winter wheat, soy beans, and chicory.

Shallow cultivation has given the best results with corn, sugar beets, and chicory. With the 2 latter crops a portion of the land was mulched with coarse sand and no cultivation given after the crops were thinned. The portions of the crops so treated gave larger yields than when they were cultivated. The author believes that in years of ordinary rainfall in the region of the station, the only benefit from cultivation during the growing season is from the removal of weeds and the preservation of moisture by means of the soil mulch produced.

Harrowing oats in rows 6 in. apart has resulted in considerably increased yields. Refuse lime from sugar-beet factories was used on corn, sugar beets, and alfalfa. Only the alfalfa seemed especially benefited by the application. With this crop the refuse lime occasioned an increase of nearly 1 ton of hay per acre.

The leaf disease (*Cercospora beticola*) affecting beets was held in check by Bordeaux mixture. Hungarian brome grass (*Bromus inermis*) has given the greatest promise of the grasses tested. Out of 100 varieties of wheat tested, Turkey Red, Big Frame, and Currell and 3 Russian varieties proved hardiest.

Alfalfa as a hay crop, B. C. BUFFUM (*Wyoming Sta. Bul. 43, pp. 47–91, figs. 8*).—Results are reported of investigations at the station and elsewhere in the State on the culture of common and Turkestan alfalfa. The growth of alfalfa on alkali soils and the irrigation of alfalfa are discussed and some figures given bearing on these 2 factors in alfalfa growing in the State.

Alfalfa has been successfully grown at the station which is located at an altitude of more than 6,000 ft. Directions are given for the preparation of the land, time and method of seeding it at this altitude, cutting, and curing. Seeding without a nurse crop is advised when difficulty in securing a good stand is met with. In tests at the station an average decreased yield of one-half ton per acre followed the seeding of alfalfa with oats for each of 3 succeeding years. The average yield of alfalfa on different plats for from 2 to 5 years has varied from 4,950 lbs. to 7,161 lbs. per acre. At altitudes below 6,000 ft. the average yield has been: At Lander, from 7,000 to 8,000 lbs. per acre; Sheridan, 10,600 to 16,800 lbs.; Wheatland, 10,380 to 20,402 lbs. At Laramie, Turkestan alfalfa has yielded at the average rate of 7,625 lbs. per acre, as compared with an average yield for 3 years of 6,030 lbs. of common alfalfa grown on plats under similar conditions. The Turkestan alfalfa has proven especially hardy at the station, having successfully withstood the severe winter of 1898–99, without apparent winterkilling, when all plats of common alfalfa were more or less injured. The author states that the principal cause of winterkilling of alfalfa seems to be the freezing of water around the crown of the plant.

Alfalfa was grown on plats containing different percentages of alkali salts. The following table shows, in a measure, the tolerance of this plant for alkali:

Tolerance of alfalfa for alkali.

	Total salts.	Sodium chlorid.
Alfalfa killed:	*Per cent.*	*Per cent.*
Salts in first 6 in. of soil	0.620	0.029
Salts in soil from 6 in. to 1 ft. deep	.792	.053
Alfalfa thrifty:		
Salts in first 6 in. of soil	.034	.000
Salts in soil from 6 in. to 1 ft. deep	.270	.003

Irrigation after alfalfa is cut and late fall irrigation are advised. A table is given showing the number of times the alfalfa plats at the station were irrigated, date of irrigation, and the amount of water applied each time. The average amount of water used on alfalfa for the season would cover the ground 2.22 ft. deep.

Dodder is noted as one of the serious foes of alfalfa in Wyoming. Plowing alfalfa under and cultivating the land for a year or two in corn, potatoes, and the like is recommended. The experience of farmers in different sections of Wyoming who have had experience in the growing of alfalfa is noted, some letters being quoted.

Some of the conclusions of the author relative to alfalfa culture in Wyoming are as follows:

"Alfalfa succeeds in all parts of Wyoming under 8,000 feet altitude where it can be irrigated, and makes more fodder to the acre than any other hay plant yet introduced. . . .

"At high altitudes alfalfa requires careful treatment to secure a good stand and become well established. Heavy seeding and planting with the press drill are recommended.

"Two seasons are required to put the alfalfa into good producing condition on the Laramie Plains. . . .

"Alfalfa will not grow on wet land where the ground water stands as near the surface as 1 or 2 ft. . . .

"Alfalfa grows better where there is some alkali salt in the soil, but will not stand more than 1 per cent of our common white alkali in the first 6 in. of soil. It should not be planted where there is enough alkali to form white incrustations on the surface of the soil during any part of the year."

Corn culture, C. W. BURKETT (*New Hampshire Sta. Bul. 71, pp. 47–58, figs. 3*). Methods of culture, effect of witch grass in growing corn, and depth of plowing in reference to corn production were the problems investigated in this experiment.

Methods of cultivating corn (pp. 47–53).—Certain corn plats were given no cultivation, others 5, and others 14 cultivations. Some of the plats were cultivated deep and others shallow. The results obtained in each case are tabulated and discussed, and a summary given of deep *v.* shallow cultivation experiments with corn at 17 experiment stations. On the plats not cultivated the weeds grew luxuriantly and the yield was reduced to 17.1 bu. of shelled corn per acre. The plats cultivated shallow 14 times yielded at the rate of 80.6 bu. of shelled corn per acre; cultivated 5 times shallow, the yield was 79.1 bu.; and cultivated 5 times deep, 69.7 bu. per acre. The amount of stover produced in each instance stood in about the same ratio as the grain production. The plat which had received a mulch averaging 3 in. in thickness of old swamp hay and given no further attention during the remainder of the season, yielded at the rate of 56.1 bu. of shelled corn per acre. The mulch was not sufficient to keep all of the weeds down. In the author's summary of the results of deep and shallow cultivation experiments carried on at other stations it is shown that out of 56 tests 36 were in favor of shallow culture, 12 in favor of deep culture, and 8 were inconclusive.

Effect of witch grass on corn production (pp. 53–55).—In this experiment witch grass was allowed to grow in the drilled rows of corn on certain plats which were cultivated but one way. Other plats were similarly cultivated except that the witch grass was removed from between the hills with a hand hoe. The yield of the hoed corn was at the rate of 81.6 bu. per acre, and of the unhoed 61.4 bu. per acre. In this experiment the increased yield of both stover and grain paid many times over for the extra labor of hoeing.

Effect of depth of plowing on yield of corn (pp. 56–58).—Plats of corn land were plowed in the fall 3, 5, 7, and 9 in. deep, respectively. The plats were similarly prepared in the spring and planted to Leaming corn. No difference was seen in the growth of the corn on the different plats until about the middle of the season when the deeper-

plowed plat showed a more vigorous and stronger growth. At the time the corn was put in the silo the plat plowed 3 in. deep yielded 14.2 tons of fodder per acre; 5 in. deep, 26.2; 7 in. deep, 29.4; and 9 in. deep, 28.2 tons per acre. It is concluded from this experiment that for a deep soil deep fall plowing is preferable to shallow plowing for corn. With impoverished soil, deep plowing can not be practiced. If the soil be shallow, it should be gradually deepened by subsequent plowing.

Results of experiments on cotton in Alabama, P. H. MELL ET AL. (*Alabama College Sta. Bul. 107, pp. 181–423, pls. 23, figs. 3*). This bulletin was prepared by the station for the Paris Exposition, and covers the following subjects: Varieties, culture, manuring, chemistry, and diseases of cotton; the improvement of cotton by hybridization and by selection, and the climate of the cotton belt. Thirty-seven previous bulletins on the different phases of cotton culture have been published by the station. The present bulletin embodies the experience of the station in its study of cotton culture up to the present time, covering a period of 16 years. Such conclusions to date or such additional matter as has not been previously recorded will be noted.

The best average record of all varieties tested 4 or more years up to the present time has been made by Truitt and Peterkin, the yield of lint cotton of these 2 varieties for 7 years being at the average rate of 425 lbs. for the former and 417 lbs. for the latter per acre.

For the purpose of classification, 70 varieties were studied comparatively in 1899, and a provisional classification of varieties made.

Results of fertilizer experiments at the station have shown that cotton-seed meal and nitrate of soda are practically equally valuable as sources of nitrogen for cotton. Cotton seed and cotton-seed meal were about equally effective. In 79 per cent of the tests with stable manure *v.* cotton seed the yields were greater with stable manure. In 1898 cotton, cowpeas, and velvet beans were grown on contiguous plats. The cowpeas and velvet beans were picked and removed from the field and all the plats plowed in March, 1899, and planted to cotton. The yield of seed cotton per acre was 1,533 lbs. following cowpeas, 1,373 lbs. following velvet beans, and 837 lbs. following cotton. In 3 other experiments the average increase of seed cotton per acre, due apparently to the plowing under of velvet beans, was 660 lbs., a gain of 72 per cent as compared with the average yield of plats where the preceding crop had been cotton. In a cooperative experiment conducted under unfavorable conditions, the average increase of seed cotton per acre occasioned by turning under cowpeas was 125 lbs. An average increase of 32 lbs. of seed cotton in 1899 was attributed to the residual effect of applying 720 lbs. of rotted cotton seed in 1898. It is believed that the average yield of cotton per acre in Alabama might be increased at least 50 per cent through the general use of legumes as fertilizers.

As to the comparative merits of acidulated and raw phosphate for fertilizing cotton and the residual effects of the same, the summarized results of all the experiments made under the direction of the station and bearing on this point seem to abundantly demonstrate the superiority of the acid phosphate.

The use of potash as a factor in controlling the black rust in cotton is summarized as follows: "Not only kainit but other soluble forms of potash, as the muriate, sulphate, and silicate may, under suitable atmospheric conditions, restrain the spread of black rust. The minimum amount required to exert a notable rust-restraining influence is not yet determined, but is between 50 and 100 lbs. of kainit per acre, and apparently nearer the latter figure."

Results of experiments in composting such materials as cotton seed, fine stable manure, cotton-seed meal, and phosphate, taken as a whole, offer no arguments in favor of the practice. Fractional applications of fertilizers have not proven advantageous. The best time for applying fertilizers is believed to be before the seed is sown. The results of cooperative experiments have shown that practically all the cotton soils of Alabama, except the central prairie region, are greatly benefited by the addition of acid phosphate. Cotton-seed meal is desirable on nearly all soils in the State except new lands and soils containing considerable vegetable matter. Kainit is less frequently needed than either acid phosphate or cotton-seed meal. It is most needed in the southern part of the State and on soils especially liable to black rust. Fertilizer formulas suitable for different sections of the State are tentatively suggested.

The section of the bulletin treating of diseases of cotton considers the following subjects: Root knot, sore shin or damping off, cotton wilt, rust, anthracnose of the stem, red rust, leaf blight, cotton mildew, angular leaf spot, cotton-boll rot, anthracnose of the boll, and shedding of bolls. Sulphur used at the rate of 16 lbs. per square rod seemed to have no beneficial effect in freeing the soil from nematodes causing root knot. In pot experiments injections into the soil of carbon bisulphid seemed to be beneficial for this purpose, but satisfactory results were not secured with it in field tests. Unpublished investigations of C. F. Baker are given as showing that the probable cause of the cotton-boll rot (at least in the case under investigation) was primarily due to the puncture of the boll by one of the small hoppers, known as "sharp shooters," after which it was attacked by various species of saphrophytic fungi which fed on the broken-down tissue of the boll. A number of these fungi were isolated, but inoculation experiments with them during dry weather failed to produce the disease. The bibliography of cotton diseases contains 47 references. A list of 64 varieties and species of fungi, recorded as growing on cotton, is also given.

Original determinations are reported of the composition of the cotton plant at 5 different stages of growth. The following table shows the composition of different parts of the entire mature plant:

Complete analysis of the entire mature cotton plant.

	Nitrogen.	Phosphoric acid.	Potash.	Lime.	Magnesia.	Ferric oxid.	Silica.	Ash.	Protein.	Fiber.	Fat.	Carbohydrates.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Roots	0.48	0.26	0.90	0.45	0.44	0.25	0.64	3.72	3.00	40.62	2.78	49.88
Stalks	.61	.21	.85	.78	.28	.21	.16	3.09	4.00	45.31	1.11	46.49
Leaves	2.25	.48	1.09	5.28	.94	.43	1.70	12.55	14.06	8.71	8.49	56.19
Bolls	1.83	.78	1.60	.51	.55	.15	.21	4.74	11.44	45.21	9.81	29.07
Seed	3.54	1.40	1.13	.32	.30	.03	.02	3.65	22.13	11.91	23.05	39.26
Lint	.18	.09	.59	.07	.14	.16	.07	1.25	1.12	87.02	.61	10.00

The fertilizer requirements of cotton as determined by the analysis of the plant are discussed, and a summary is given of the effect on butter of feeding cotton seed and cotton-seed meal (E. S. R., 3, p. 6).

The southern or cow pea in Delaware, A. T. NEALE and W. H. BISHOP (*Delaware Sta. Bul. 46, pp. 3-9, 12-24*). —Following a popular comparison of the relative merits of crimson clover and cowpeas for culture in Delaware are given some results obtained in cultural, fertilizer, and variety tests with this crop. The actual cost of raising and ensiling 1.37 acres of mixed Whippoorwill and Black cowpeas at the station was at the rate of $17.92 per acre (including a land rental of $5 per acre) or $1.36 per ton of silage grown. Analysis showed that about 5.25 tons of the silage contained more protein, fat, and carbohydrates than a ton of ordinary bran.

The botany of the cowpea is touched upon and some results obtained in previous fertilizer tests with this crop are (E. S. R., 6, p. 802) given. The varieties most suited for cultivation in Delaware are Whippoorwill, New Era, Black, Clay, Unknown, and Black-eyed. These varieties are described and the characteristics of each noted. Twelve other early varieties and 28 late varieties tested at the station are also briefly characterized. New Era has given the largest yields of any of the varieties tested at the station, the average for 2 years being 24,218 lbs. per acre.

Experiments were made to determine the effect upon plant development of cowpeas due to geographical differences in the source of the seed and to variation in the amount of seed planted per acre. The seed of a number of varieties was obtained from nearly every Southern State and grown at the station. No evidence was obtained in these tests that seed grown in the far South required any longer season for maturing a crop at the station than the same variety grown some hundreds of miles farther north; and there seems to be some evidence that Delaware grown seed is as good for crop production as that obtained farther south. In 1898 seeding Whippoorwill peas at the rate

of 2 pk. per acre, yielded better results than 1 pk. per acre and about as good results as 3, 4, or 5 pk. per acre.

The relation of the weather to cowpea production is discussed. In 1898 the average production of 5 different varieties of cowpeas was about one-fourth larger than in 1897. In 1898 the rainfall for the months of June to October, inclusive, was 5.35 in. more and the average temperature 2.4° F. higher than for the same months in 1897, and it was thought the increased yields of cowpeas in 1898 might have been due to these causes.

A two year's test of 128 varieties of grasses and forage plants, T. L. LYON (*Nebraska Sta. Rpt. 1899, pp. 122–171*).—A report is given on the results of 2 years' testing of 128 varieties of grasses and forage-plant seeds, which were contributed to the station by the Division of Agrostology of this Department. The collection was composed almost entirely of seeds of native or foreign wild grasses and of cultivated foreign grasses, there being very few of the grasses ordinarily cultivated in that region. The test has continued through 3 summers and 2 winters, and while not long enough time has elapsed to indicate with any degree of certainty the value of any of these grasses for this region, it is demonstrated that a large number can not be successfully grown. Of the number tested only 16 have survived the entire period of the test, as follows: *Agropyron repens*, *A. tenerum*, *Arrhenatherum elatius*, *Bromus ciliatus*, *B. inermis*, *B. tectorum*, *B. unioloides*, *Elymus canadensis*, *E. glaucifolius*, *E. virginicus*, *Eragrostis trichodes*, *Festuca elatior arundinacea*, *F. ovina duriuscula*, *F. ovina elatior*, *F. ovina sulcata*, *F. elatior pratensis*, *Hordeum pratense*, and *Stipa robusta*.

The influence of chlorin and other compounds in crude Stassfurt salts on the composition and yield of potatoes, B. SJOLLEMA (*Jour. Landw., 47 (1899), No. 4, pp. 305–357*).—Investigations were made on the effect of chlorin compounds on the composition and yield of potatoes, with special reference to those found in crude Stassfurt salts. The article contains, besides an account of the author's experiments, a review and discussion of the results obtained by other investigators along the same lines. Potassium chlorid, sodium chlorid, and magnesium chlorid lowered the starch content materially, each to about the same extent. The reduction was greatest in the case of varieties relatively rich in starch. New varieties and those making a heavy growth of tops were especially sensitive to chlorids.

Investigations on the chlorin content of potato tubers showed that it is increased by the application of chlorids in the spring. With the higher chlorin content of the tuber is associated a higher water content and a lower starch content. The potash content of the entire tuber was about the same whether the chlorid or the sulphate was applied, but the potash content of the dry matter was much higher in

the former case—that is, with chlorin a less amount of organic matter had been elaborated. This higher percentage of potash was present entirely in the original form of potassium chlorid, which is, in the author's opinion, the cause of the increased water content of potatoes grown with it. It is suggested that the low starch content of the tubers may be accounted for by the presence in the sap of the relatively large amount of potassium chlorid, thus interfering in some way with the formation of starch. The relation of starch content to potash content was found not to be uniform in different varieties. Some required a larger amount of potash to manufacture a given amount of starch than did others.

Experimental inquiries were made with regard to the substitution of soda or magnesia for potash. Soda was never found in the tubers, at least not in any considerable quantity, though it was found in the tops of plants to which it had been applied. Magnesia was found in small quantities, about one-twentieth to one-tenth of the amount of potash present, but in the case of neither soda nor magnesia did addition of these elements diminish the potash requirements of the plant.

The yield of the tubers was only slightly reduced by application of potassium chlorid, but was much reduced by additions of magnesium chlorid or sodium chlorid. When either of the latter elements were applied to a plat which had already received liberal applications of potassium sulphate, the yield was considerably less than on a check plat which had received no fertilizer at all, showing that the good effect of the sulphate of potash is more than counteracted by the ill effect of these chlorids; but magnesium sulphate and sodium sulphate produced no unfavorable effect. On the contrary, experiments indicated that these salts slightly increased the yield and starch content of potatoes, and decreased the potash content of the tubers.

Sugar-beet investigations in 1899, J. H. Stewart and B. H. Hite (*West Virginia Sta. Bul. 64, pp. 155–176, map 1*).—The experiments with sugar beets at the station in 1899 involved a study of the influence of different fertilizers and of lime upon the sugar content and purity of the juice, different dates of planting and harvesting, tests of varieties, and cooperative culture experiments carried on with farmers throughout the State.

Excessively wet weather interfered with the fertilizer and lime experiments, but the results show that the stand of beets was practically the same on limed and unlimed plats. When lime was used alone on the plats there was a slight improvement in the sugar content and purity of the juice; used with commercial fertilizers or barnyard manure, it seemed to have the opposite effect. Stable manure seemed to increase the impurities in the juice; while the use of acid phosphate regularly gave the highest coefficients of purity.

In the variety tests scarcely any difference was found between the

relative values of Vilmorin, Mangold, Zehringer and Kleinwanzlebener. Beets planted May 29 contained more sugar in the juice and juice of purer quality than beets planted either before or after that date. Not much variation occurred in the sugar content and purity of the juice of beets harvested at different dates between September 18 and November 9. Analyses and other data, such as dates of planting and harvesting, character of soil and of the fertilizers employed, etc., are given for 155 samples of sugar beets grown by as many different farmers throughout the State. The average weight of the capped beets grown was 14.9 oz., sugar in the juice 12.77 per cent, purity of the juice 76.15 per cent. The result of the season's work is considered favorable and the work will be continued.

Sugar cane field and laboratory results for ten years, W. C. STUBBS (*Louisiana Stas. Bul. 59, 2. ser., pp. 284-337*).—This bulletin covers experimental work on the preparation of the soil, kind and quantity of cane to plant, proper fertilizers, and rational modes of cultivation. Attention is called to drainage as the first and most important essential in the preparation of the soil. Surface drainage is usually practiced in Louisiana. The merits of tile drainage are pointed out; but owing to the filling of the tiles by silt natural conditions are against its success in the locality.

During the 10 years' work at the station, foreign varieties of cane from nearly every sugar-producing country on the globe have been tested. Owing to the great difference in climate, the trials have not been satisfactory. The trials of seedlings are much more promising, and 3 such have been found of value.

In trials covering 6 years of plant and first and second year stubble for seed, purple plant has given slightly the best results as regards sugar content, while striped first-year stubble has given the largest yield in tonnage. When the results of both purple and striped varieties are combined, first-year stubble leads in tonnage, followed by second-year stubble. The inference drawn from the results of this work is that good stubble cane is fully the equal, if not the superior, of plant cane for seed.

It is estimated that one-sixth of the entire crop of cane in the State is used for planting. Experiments carried on for 13 years to test the availability of the less valuable upper third for this purpose are summarized, showing the results of chemical analyses of cane grown continuously from tops, middles, and butts. The results show but little difference as regards the value of the different portions of the cane for propagation, and the use of the upper third of the cane, which possesses little or no sugar value, but serves rather to increase the molasses output, is recommended from an economical standpoint.

In trials to determine the influence of planting large, medium, and small canes, selected continuously from plantings of large, medium, and small canes, respectively, the results show diminished yields from

using small, inferior stocks, and the conclusion is reached that it will be most profitable to plant large, strong, and vigorous canes for seed.

The composition of the roots, stalks, leaves, and tips of Louisiana sugar cane was investigated, with the following result:

Analyses of sugar cane (water-free materials).

	Proportion of whole plant.	Organic matter.	Ash.	Nitrogen.	Phosphoric acid.	Potash.	Lime.
Purple cane, cut November 12:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Roots	4.50	90.882	8.624	0.494	0.279	0.273	0.400
Stalks	57.50	97.076	2.665	.259	.248	.289	.124
Leaves	23.13	86.567	12.969	.464	.190	.453	.845
Tops	14.87	88.170	10.773	1.057	.203	.545	.566
Striped cane, cut December 23:							
Roots	4.70	90.645	8.849	.506	.308	.573	.361
Stalks	56.82	96.728	3.055	.217	.302	.578	.144
Leaves	26.31	84.690	14.853	.457	.214	.934	.864
Tops	12.17	87.335	11.592	1.073	.564	.696	.415

The roots and stubble of cane are usually left in the soil, but it is a common practice in Louisiana to burn the tops and leaves. "A ton of purple cane as grown in Louisiana with its accompanying trash burnt in the field will thus remove 2.98 lbs. of nitrogen, 1.04 lbs. of phosphoric acid, 1.22 lbs. of potash, and 0.52 lb. of lime. A ton of striped cane, under similar conditions, will remove 2.38 lbs. of nitrogen, 1.30 lbs. of phosphoric acid, 2.34 lbs. of potash, and 0.58 lb. of lime."

The results of extended nitrogen, potash, and phosphoric acid experiments with sugar cane are given in detail. Earlier work with these fertilizers has been previously noted (E. S. R., 7, p. 678). Nitrogen not to exceed 48 lbs. per acre has been found profitable, and the best results followed when it was used in combination with phosphoric acid and potash. Sulphate of ammonia was found to be the best form of nitrogen for this crop, with cotton-seed meal a close second, followed by fish scrap, nitrate of soda, and tankage, in the order named. The increased cost of sulphate of ammonia in the local markets does not, in the opinion of the author, justify its use over cheaper forms. Data as to the amount of fertilizers applied and removed from plats devoted to sugar culture for 10 years are given.

In the fertilizer test with phosphoric acid for cane, small applications, not exceeding 36 lbs. per acre, were found most profitable. The soluble forms gave better results than the insoluble. Applications of from 200 to 300 lbs. of phosphoric acid are considered sufficient for a good average crop at the station. Tests of the different potash salts showed that this element was not needed in the station soils.

With regard to the effect of the different fertilizers on the sugar content the author states that heavy applications of nitrogenous fertilizers applied late in the spring tend to produce immature canes low in sugar content. Nitrogen should, therefore, be applied early in the growth of the cane. Neither potash nor phosphoric acid by itself has an influence on the sugar content, but when used with nitrogenous

fertilizers they cause a more rapid growth and a quicker maturity of the cane.

In 1894, and every year since, experiments have been carried on in making 1, 2, and 3 applications of an equal amount of nitrogen in the form of nitrate of soda and sulphate of ammonia. The results have been contradictory and no conclusions are drawn.

In a comparison of deep and shallow cultivation of cane with plows and cultivators, respectively, better results were obtained by shallow cultivation with cultivators. The author believes that, should every planter adopt the method of shallow cultivation of his soil after thorough preparation, the yield of cane would be increased in the State from 5 to 10 tons per acre.

Condensed tables of the weather record of 1897, 1898, and 1899 are given.

Work of the Hawaiian Experiment Station, 1899, W. MAXWELL (*Honolulu: Hawaiian Gazette Company, 1899, pp. 36*).—This report covers results obtained during the year in fertilizer, irrigation, variety, and seedling experiments with sugar cane. In the fertilizer experiments sulphate of potash and double superphosphate were used alone, together, and combined with different forms of nitrogen. Two varieties of cane, Rose Bamboo and Lahaina, were used, the experiment being thus carried out in duplicate. The yields of cane, leaves, and sugar per acre, and the composition of the cane and leaves as regards mineral matter and nitrogen for each variety grown, are shown in tabular form, and the results discussed. In no case in these tests has the use of phosphoric acid resulted in increased yields of sugar. The yields when potash or nitrogen was used were considerably increased, and to about an equal extent. When these elements were used together still larger returns were obtained.

An analysis is given of the sugar-cane soils of the station, and the percentages and total amount of the different elements and acids immediately available to a depth of 15 in. are shown. The available amounts of the 4 most vital elements were as follows: Lime, 37,669 lbs.; potash, 25,419 lbs.; nitrogen, 6,519 lbs.; and phosphoric acid, 45,937 lbs. The amount of these elements removed by the crop grown and the total yield of dry matter of the crop are shown in the following table:

Yield of dry matter in sugar cane and the amount of vital elements removed per acre.

	Yield of of dry matter.	Removed per acre.			
		Lime.	Potash.	Phosphoric acid.	Nitrogen.
Rose Bamboo:	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Cane	47,632	71	258	83	133
Leaves	52,800	301	882	81	279
Lahaina:					
Cane	44,403	50	121	51	119
Leaves	52,620	262	807	69	221

The great value of returning to the land partially rotted trash (leaves and tops) and plowing under rather than burning is pointed out. If the mud press-cake and molasses are applied to the land, one-fifth of the potash and one-third of the nitrogen removed in the cane is also saved.

In the irrigation tests 20 plats were regularly irrigated, receiving from 46.5 to 48 in. of irrigation water, and 8 others received no irrigation whatever. The average yield of sugar on the 20 irrigated plats was 24,755 lbs. per acre, and on the unirrigated plats, 1,600 lbs. The rainfall during the growth of the cane was 46.56 in., most of which fell during the colder months. Some results obtained in overirrigation are given and the evil effects of this practice are pointed out.

Experiments in testing 13 varieties of cane and in planting 1 and 2 continuous cut and uncut canes in the row, and 1-eye pieces 6, 12, and 18 in. apart, are under way and are briefly reported upon. Some results obtained in planting 1 and 3 eye pieces of plant cane 11 months old are given, showing that "1,901 pieces of cane, bearing 1,901 eyes, produced relatively as many canes as 2,411 pieces of cane bearing 7,233 eyes. Out of the 7,233 eyes, 4,697 died." The results lead the author to urge experiments by planters in the use of less seed than is usually planted.

The results of some analyses by the aspartic-acid method of soils yielding from 1 to 4 and from 5 to 10 tons of sugar per acre are tabulated, and some notes are given on the value of lime in sugar soils.

Important problems in plant breeding, W. EDLER (*Landw. Wchnbl. Sachsen, 2 (1900), Nos. 35, pp. 303, 304; 36, pp. 310, 311*).—Some of the more important points to be observed in the breeding of a number of the more prominent cereal and root crops are discussed.

Grain breeding, T. MANSHOLT (*Fühling's Landw. Ztg., 49 (1900), Nos. 8, pp. 296–299; 9, pp. 327–334*).—A discussion of the principles and methods involved in the improvement of grains by selection, etc.

The effect of size of seed on the crop, T. H. MIDDLETON (*University College of Wales Rpt. 1899, pp. 68–70*).—Wheat, oats, and beans were used in this experiment and large and small seed of each crop planted. The most striking results were secured with wheat. The yields obtained from the large seed were almost double those obtained from the small. The difference was less marked with oats. With beans practically the same results were secured with small as with large seed.

Field experiments, J. A. MURRAY and T. H. MIDDLETON (*University College of Wales Rpt. 1899, pp. 3–26, 31–42*).—Results are given of a number of cooperative experiments with fertilizers on grass lands, potatoes, and root crops.

Field experiments (*Bd. Agr. [London] Rpt. Agr. Education, 1899–1900, pp. 37–42, 45–71, 74–89, 91–96, 99–107, 110–113, 117–124, 126–133*).—The experiments reported have been carried out at eight different collegiate institutions. They consist of fertilizer experiments with swedes, potatoes, hops, mangolds, grass lands, and permanent pastures; seeding experiments with alfalfa and sainfoin; and rotation experiments. A number of the fertilizer experiments reported have been noted from other sources.

Farm experiments at Dalmeny (*Farm and Home, 19 (1900), No. 969, p. 294*).—A semiofficial summary is given of the results secured in the experimental work being carried out on Lord Roseberg's farm. An application of 4 cwt. of ground lime yearly has given better results than where much larger amounts have been

applied only at long intervals. Heavy applications of lime have been useful in controlling the finger-and-toe disease of turnips, but are considered to have a prejudicial effect on nitrifying and other advantageous soil organisms.

Methods of applying fertilizers, BERTHAULT (*Ann. Agron., 26 (1900), No. 9, pp. 417-430*).—Broadcasting, applying in drills or in small amounts about each plant, etc., are considered for a number of crops.

Experiments with manures (*Farmers' Gaz., 59 (1900), No. 39, p. 753; Agr. Gaz. [London], 52 (1900), No. 1394, p. 181*).—Results secured in the use of different amounts of city manure, in the substitution of commercial fertilizers for a part of the city manures employed, and in the use of commercial fertilizers alone for growing certain vegetables and farm crops are given.

Culture of textile plants, G. D'UTRA (*Rev. Agr. Réunion, 6 (1900), Nos. 60, pp. 241-248; 61, pp. 281-290*).—Discussion of the culture, fibers, and manufacture of different textile plants.

Azof barley (*Agr. Jour. Cape Good Hope, 17 (1900), No. 6, pp. 322-324*).—This barley was tested by a number of farmers to determine its merits as a forage crop. The results reported are somewhat contradictory.

Notes on cereals, T. H. MIDDLETON (*University College of Wales Rpt. 1899, pp. 61-67*).—The characteristic differences between young oat and barley plants, barley and wheat plants, wheat and rye plants, and wheat and oat plants are given, together with the distinguishing characteristics of a large number of varieties of oats.

Report on tests of deep and shallow plowing for corn (*Nebraska Sta. Bul. 64, pp. 94-97*).—Of reports on tests of deep and shallow plowing for corn from 16 correspondents living in different sections of the State, 9 show an increased yield of corn resulting from deep plowing, 4 no difference in yield from either deep or shallow plowing, and 3 an increased crop from shallow plowing. Relative to the effect of drought on the corn on the shallow and deep plowing, 8 correspondents report that the corn suffered more on the shallow plowing. In 5 cases there was no difference and in 3 cases the corn on deep-plowed land suffered more.

Introduction of American varieties of maize, G. VALDER (*Agr. Gaz. New South Wales, 11 (1900), No. 9, pp. 782-785*).—Nine varieties of corn were imported from the United States and distributed to farmers in New South Wales. The present article tells of the growth of the corn and includes some notes on the different varieties by growers. It has been noticed that the grain has been considerably improved since it has been grown in New South Wales. It is larger, well developed, and has a much better appearance for market purposes.

Rescue grass (Bromus unioloides), F. LAMSON-SCRIBNER (*U. S. Dept. Agr., Division of Agrostology Circ. 26, pp. 4, fig. 1*).—A brief description with notes on the history, cultivation, use, and feeding value.

Analyses of forage crops, H. H. NICHOLSON (*Nebraska Sta. Rpt. 1899, pp. 40-42*).—Analyses (food constituents) are given for green, air-dried, and water-free *Bromus inermis*, oats and field peas, cowpeas and millet, sorghum, and alfalfa.

Succulent forage for the farm and dairy, T. A. WILLIAMS (*U. S. Dept. Agr. Yearbook 1899, pp. 613-626, pls. 2*).—The topics, historical and popular, discussed under the above heading are early forage conditions in the United States, place of succulent forage crops on the farm, growth of the practice of soiling in the United States, temporary pastures, history of the practice of ensiling, value of silage as a forage for stock, and the best crops for succulent forage. Under the latter heading, a number of the more important forage crops grown in this country are discussed.

Hemp (Cannabis sativa), S. S. BOYCE (*New York: Orange Judd Co., 1900, pp. X+112, figs. 13*).—"A practical treatise on the culture of hemp for seed and fiber, with a sketch of the history and nature of the plant." The work takes up the history, botany, and chemical composition of the hemp plant and its culture in Europe and America. In the discussion of its culture in the latter country methods of retting and preparing the fiber and machinery for handling hemp are discussed.

Winter oats for grain and pasture (*Rural New Yorker, 59 (1900), No. 2637, p. 543*).—The successful culture of winter oats when seeded in August at the Delaware Station are reported by A. T. Neale. The oats bore from 30 to 50 berries per stalk and the yield was between 7 and 8 tons of green forage per acre.

On the origin and variability of the potato, E. André (*Rev. Hort., 72 (1900), No. 19, pp. 542, 543*).—The adaptation of the potato to great variations in climate and soil and its variability in such locations are pointed out and some notes given on the growth of potatoes in Colombia and Ecuador. Some suggestions are added relative to the introduction and improvement of native South American and Mexican potatoes.

Potato growing experiments (*Queensland Agr. Jour., 7 (1900), No. 3, p. 215*).—The summarized results of some fertilizer and cultural tests with potatoes are given. The use of 20 tons of barnyard manure resulted in the largest yields and tubers of the best cooking qualities. Sprouted seed tubers gave better yields than nonsprouted.

Trials of potatoes at the Wagga Experiment Farm, G. M. McKeown (*Agr. Gaz. New South Wales, 11 (1900), No. 9, p. 786*).—Data as to the yields obtained in tests of 10 varieties.

The effect of different potash salts on the composition and yield of potatoes, T. Pfeiffer (*Landw. Vers. Stat., 54 (1900), Nos. 5–6, pp. 379–385*).—Work along this line by the author has been previously noted (E. S. R., 10, p. 140). In the present instance magnesium chlorid used in connection with potassium sulphate decreased the percentage of starch in varying amounts in 4 varieties of potatoes. Fresh tubers which had been fertilized with chlorid of potash contained about 0.12 per cent of chlorin, while those fertilized with sulphate of potash contained about 0.05 per cent.

The influence of manures on the quality of potatoes, J. W. Paterson (*West of Scotland Agr. Soc. Bul. 4, pp. 27–35*).—The quality of potatoes as affected by different commercial fertilizers and barnyard manure was investigated. In 12 out of 16 cases the use of barnyard manure injured the quality of the potatoes. The potatoes showing the highest starch content had been fertilized with a mixture consisting of 672 lbs. of superphosphate, 224 lbs. of sulphate of ammonia, 112 lbs. of nitrate of soda, and 224 lbs. of sulphate of potash per acre.

Indian millets or sorghums grown at Wollongbar, H. V. Jackson (*Agr. Gaz. New South Wales, 11 (1900), No. 9, pp. 759–763, figs. 36*).—Notes on the cultivation of sorghum in India with data on the development of 45 varieties imported from there and grown in New South Wales.

Sorghum for sirup, G. W. Shaw (*Oregon Sta. Bul. 62, pp. 3–6*).—A number of varieties of sorghum were distributed by the station in some of the districts of Oregon which seemed most suited to the culture of this crop. Some data as to the growth of the stalks and the sugar content of the juice of samples from 28 different localities are tabulated. The crop made a fair growth in Jackson and Umatilla counties. Late varieties matured with much uncertainty in the latter county.

Growth of the tobacco industry, M. Whitney and M. L. Floyd (*U. S. Dept. Agr. Yearbook 1899, pp. 429–440, pls. 7*).—An historical review of the development of the tobacco industry in Maryland and Virginia and of its extension to other States, with an account of the use of Connecticut tobacco in the cigar industry; requirements of the foreign tobacco trade; manufacturing, smoking, and domestic cigar tobaccos grown and handled in the United States; and statistics of the manufacture of tobaccos, snuff, cigars, and cigarettes in this country, and of leaf tobacco exported from the United States.

Fermentation of tobacco, T. H. Vernhout (*Meded.'s Lands Plantentuin, 1899, No. 34, pp. 49, pls. 2; abs. in Centbl. Bakt. u. Par., 2. Abt., 6 (1900), No. 10–11, pp. 377, 378*).—Maintains that it is bacterial and that oxydase and peroxydase have no part in the fermentation of Java tobacco.

HORTICULTURE.

Gardening under glass, W. F. MASSEY and A. RHODES (*North Carolina Sta. Bul. 170, pp. 24*).—Under this heading a test of the main varieties of tomatoes for winter forcing is reported, and an essay appended on the use of glass in North Carolina in gardening for the market. Tomato plants were grown in 10-in. pots filled with a mixture of one-half ordinary potting compost and one-half Jadoo fiber and trained to single stems. Pollination was secured by removing pollen with a camel's hair brush and applying the brush bloom by bloom. The dates of gathering and yield of each picking from January to March, inclusive, are shown in tables for each variety. Comments on the character and yield of each variety are appended. Maule Earliest gave the largest yield of any of the varieties tested. It was also the earliest variety grown. The author believes that if this tomato could be bred into a smooth variety it would leave little to be desired as a tomato. In its present irregular shape it is considered unsatisfactory for forcing. Maule Imperial, New Forcing, Stone, and White Excelsior were all promising varieties for forcing. Tapping the plants at noon for the purpose of pollination resulted in an imperfect setting of fruit and rapid falling off in size as compared with the results obtained when hand pollination was practiced.

In the essay on the use of glass for market gardening in North Carolina the subjects of cold frames, sowing lettuce seed for first and second crops, building cheap greenhouses, etc., are discussed.

Forced peas in pots, G. WYTHES (*Garden, 58 (1900), No. 1505, pp. 231, 232, fig. 1; Amer. Gard., 21 (1900), No. 302, pp. 663, 664*).—Forcing peas in pots under glass and varieties suitable for the purpose are discussed. In the author's experience the most satisfactory methods of growing have been to sow from 8 to 12 seed in 9 or 10 in. pots and thin to half the number when the seedlings are strong enough. The soil used should be a firm loam to which bone meal or well-rotted manure has been added, a space being left at the top for later top-dressings. The peas may be planted in the early part of December and the pots placed in cold frames. The sashes should be kept closed until the peas are well above the soil. But little moisture and no heat is required until the plants become well rooted—probably in February. Liquid manure is beneficial as growth proceeds. Sowing in small pots and transplanting to larger increases the labor without benefit to the plants. In case pot plants can not be grown, planting out in frames early in the year, say in January, is advocated. Robust plants which grow from 2 to 3 ft. high are considered most suitable for this purpose. For pot culture very small varieties—6 to 9 in.—are not in favor. Though early they are less prolific than stronger-growing varieties.

One of the best varieties for early pot culture is May Queen. This is a 3-ft. pea, hardy, pods freely, and the peas have a marrow-fat

flavor. Under glass it seldom exceeds 2 ft. in height. Carter Daisy is considered an excellent variety to follow May Queen. This variety grows 2½ ft. high, but may be dwarfed by topping. Gradus, when not forced too hard and grown as cool as possible, is another good variety for forcing, as is also Early Morn. Carter Daisy has proven the most valuable for growing in a warm border in the open.

Apple production in Virginia, W. B. Alwood (*Virginia Sta. Bul. 101, pp. 107–125, map 1*). Statistics obtained in cooperation with the traffic managers of Virginia railroads are given for the shipment of apples from each station along the line of the different roads. Indication is made as to the destination of the shipment, whether to northern or southern tide water, northern or western States, local markets within the State, or to southern States. The matter is also grouped with reference to the apple production of different counties. The shipments of dried apples are noted in some instances. The data are given in detail for 1899. Some data for 1897 and 1898 are also reported. The total production and distribution for the apple crop for 1899 is summarized as follows:

Apple shipments in Virginia in 1899.

	Barrels.
Northern tide water shipments	111, 589. 0
Southern tide water shipments	38, 452. 0
Northern and western distribution	14, 708. 5
Southern distribution	37, 380. 5
Local shipments in the State	10, 355. 0
Total production	212, 485. 0

Analyses of strawberries, G. W. Shaw (*Oregon Sta. Bul. 62, pp. 6–9*).—Physiological, sugar, acid, and ash analyses are reported for a number of varieties of strawberries and the averages of these analyses compared with similar analyses made elsewhere and with analyses of a number of other fruits and vegetables. The analysis with reference to sugar and acid is shown in the table below:

Analyses of strawberries.

Variety.	Average weight.	Flesh.	Waste (hulls).	Sugar. Grape.	Sugar. Cane.	Sugar. Total.	Malic acid.	Nitrogen.	Albuminoids (N. × 6.25).	Proximate composition. Water.	Proximate composition. Organic matter.	Proximate composition. Ash.
	Grams.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Michael Early	2. 39	94. 47	5. 53	3. 07	1. 59	4. 66	1. 08	0. 10	0. 62	91. 52	8. 15	0. 33
Vick	10. 66	97. 27	2. 73	3. 21	. 93	4. 14	. 95	. 18	1. 12	81. 70	17. 91	. 39
Warfield	6. 66	96. 80	3. 20	3. 94	1. 08	5. 02	. 89	. 11	. 69	90. 45	9. 18	. 37
Glendale	11. 30	97. 00	3. 00	3. 27	. 88	4. 15	1. 01	. 18	1. 12	88. 23	11. 45	. 32
Sharpless	5. 59	97. 54	2. 46			6. 18	. 72	. 18	1. 12	88. 22	11. 42	. 36
Wilson	1. 86	97. 59	2. 41			5. 90	. 80	. 12	. 72	88. 14	11. 20	. 66
Oregon Everbearing	6. 96	96. 56	3. 44			10. 00	. 40	. 10	. 62	87. 30	12. 12	. 58
Magoon	18. 33	97. 38	2. 62			6. 18	. 19			88. 72	10. 79	. 49
Clark Seedling	8. 43	95. 36	4. 64	5. 44	. 62	6. 06				89. 02	10. 69	. 25
	8. 39	96. 66	3. 34	3. 79		5. 80	. 75	. 17	. 86	88. 57	11. 43	. 41

A composite sample of the ash of the strawberries analyzed shows it to contain 39.86 per cent potash, 13.99 per cent of phosphoric acid, and 4.2 per cent of lime.

Investigation and improvement of American grapes at the Munson Experiment Grounds from 1876 to 1900, T. V. MUNSON (*Texas Sta. Bul. 56, pp. 217–286, pls. 20*).—In this bulletin the author surveys in outline the whole field of his more than 20 years' work in the study and improvement of grapes.

The wild or native grapes of the United States are considered in great detail, the natural distribution of the different species being noted and a table presented of their cultural properties, in which are shown the soil preferred by each species; endurance to cold, heat, and drought; resistance to phylloxera, mildew, and black rot; size of the cluster and berry; persistence to pedicel; quality of fruit; season of leafing, flowering, and ripening; and vigor of growth.

In accordance with the cultural facts presented in the table *Vitis vulpina*, *V. rupestris*, and *V. longii*, named in order of preference, are recommended as excellent grape stocks on sandy soils for northern regions of countries like California, France, and other temperate climates where Vinifera grapes succeed. For moderately limy soils *V. rupestris* and *V. doaniana* are recommended and for very limy soils, where the ground does not freeze over 18 in. deep, *V. champini*. For grape stocks for any soil in very hot, dry regions, such as southwest Texas and south California, *V. champini*, *V. doaniana*, *V. berlandieri*, *V. candicans*, and *V. monticola* are recommended. "The last 3, being difficult to grow from cuttings, are better utilized in hybrid varieties with the first 2 and with *V. rupestris*. *V. monticola*, *V. berlandieri*, *V. candicans*, and *V. champini*, while doing finely in sandy soil, grow the best of any species in very limy soils, up to 60 per cent of carbonate of lime."

In breeding direct producers of fruit for market and table for the North the best varieties of *V. labrusca*, *V. vulpina*, *V. lincecumi*, *V. bicolor*, *V. rupestris*, and *V. doaniana* are to be selected, using the hardiest and healthiest varieties of *V. vinifera* in attenuation of ¼ to ½ or less, by using hybrids and hybrids of hybrids as parents. In the breeding of direct producers for the South, the range is very great. Any of the above may be used with the addition of *V. champini*, *V. bourquiniana*, *V. berlandieri*, *V. monticola*, *V. rotundifolia*, and for Gulf regions and Florida, *V. simpsoni* and *V. munsoniana*.

As to species for wine, "it is found that small-berry species generally possess properties for wine making far superior to the large-berry species, hence if one seeks to produce varieties for wine making he should not neglect those with small berries. The species possessing best wine properties are those in the series Ripariæ, Viniferæ, Æstivales, Cinerascentes, and Coriaceæ, especially the species *rupestris*, *bourquiniana*, *lincecumii*, *berlandieri*, *champini*, *doaniana*, and *vinifera*."

Reviewing these species selected for special purposes, it is found that American viticulture is based on the following species: *Rupestris, longii, vulpina, monticola, berlandieri, bourquiniana, vinifera, lincecumii, bicolor, æstivalis, simpsoni, candicans, doaniana, champini, labrusca, rotundifolia*, and *munsoniana*, 17 in all.

"These with proper application as to climate and soil can well supply all parts, from Puget Sound and Dakota to Puerto Rico. All the other species can be neglected without loss. An abridgement of the above, which would still supply nearly every requirement, and be the best possible list for the number of species included, would be *rupestris, vulpina, berlandieri, bourquiniana, vinifera, lincecumii, simpsoni, doaniana, champini, labrusca*, and *rotundifolia*."

The work involved in hunting the forests for desirable varieties of grapes to be used as parents is noted, and a partial list of varieties of grapes that have been or are growing at the Munson Experiment Grounds given. Following this the author discusses the ideal variety of grape and the personal qualifications necessary in an originator of varieties and gives an account of the methods followed by himself in the creation of new varieties by pure breeding, crossing, and hybridizing. Crossing and hybridizing when the parent vines bloom at the same and at different times are dwelt on at some length.

"When the intended parent vines do not bloom at the same time, then either the earlier variety must be retarded by cutting off the primary shoots, thus forcing the secondary later, or the later must be made to bloom earlier by pruning close in the fall, soon after the leaf fall, and the earlier delayed as directed above or by not pruning until buds start in the spring or by both, if the natural times of flowering of the 2 intended parents are wide apart, or else by saving pollen of the earlier to apply to the stigma of the later. Pollen can be preserved for weeks and even a year and still be efficient in impregnating."

Directions for collecting and preserving pollen and using the same the following season are given.

The general laws of constitutional development in grapes with reference to the parentage in pollination is stated by the author as follows:

"The most vigorous and enduring progeny are produced by vines as mothers—other things being the same—which have recurved stamens and well-developed pistils, when pollinated by purely staminate vines, as, for example, when Moyer, Lindley, Brighton, etc., are pollinated by staminate seedlings of, say, Dracut, Perkins, Presley, etc.

"Next in vigor are the progeny of mothers having reflexed stamens with large pistils, impregnated by hermaphrodite vines; e. g., Brighton or Lindley by Concord, Ives, Delaware, etc.

"The third in vigor and endurance would be the progeny of hermaphrodite vines, such as Concord, Ives, Perkins, Catawba, and the majority of varieties in cultivation, impregnated by staminate vines. But in this case the majority of the progeny will be staminate vines.

"Fourth in vigor would be the progeny of hermaphrodite vines pollinated by other hermaphrodite vines—for example, Concord pollinated by Delaware or Ives—and still weaker if pollinated by itself or its own progeny, such as Moore Early, Worden, Martha, etc., making 'in-and-in' breeding. The progeny of such impregnations gen-

erally have hermaphrodite or self-pollinating flowers, the kind preferred by vineyardists, who do not understand sex among vines, because they bear planted alone in vineyards. Most hybrids of Labrusca with Vinifera have been of this class.

"More feeble still, when any progeny at all are produced, is that of vines with recurved stamens, impregnated by varieties with recurved stamens, as in case Moyer could be impregnated by Brighton or Lindley.

"In case a variety with recurved stamens should impregnate itself, if possible, we would expect the feeblest progeny. Such impregnations, however, are very rare, if [occurring] at all. Pistillate varieties thus pollinated generally cast the pistils in a few days afterwards, but the pistils may first enlarge a little. Prof. S. A. Beach has designated such varieties 'self-excitant' or 'self-irritant,' but sterile."

Specific directions for sowing and planting seed, tending and cultivating the seedlings planted in the testing vineyard, noting and selecting the seemingly desirable varieties and breeding with special reference to color of grape, season, size of cluster or berry, or for quality, are given. In the author's experiments only about one really good variety was obtained out of every 1,000 carefully selected and hybridized grape seed grown.

In the course of his work in breeding grapes, Munson has made observations on the prepotency of the different species and the peculiar effect of each on the offspring. Only a few of them need be mentioned here: *V. rupestris* does not seem to be a good mother but in France is considered superior to all other species as a pollenizer of *vinifera* to give direct producers. *V. berlandieri* offers an excellent basis on which to build for large compound clusters and fine quality of berry. *V. lincecumii*, in the opinion of the author, promises more for American grape culture than any other and possibly all other species combined. Among the families of this group, America is uncommonly healthy and vigorous, very prolific, and is a good table and wine grape, and one of the best mothers. A hybrid of *V. bicolor* and *V. vulpina* promises to give rise to a family of very hardy varieties peculiarly adapted to the extreme north. *V. labrusca* is noteworthy for the large number of pure varieties for northern regions to which it has given rise. *V. simpsoni* endures great heat and drought and resists fungus diseases well, especially black rot, and promises well as a base for Gulf State varieties for extremely late ripening. *V. champini* promises much in hybrid combinations. It is a good graft stock for dry, very limy, adobe, or sandy soils, either North or South.

Relative to prepotency or superior potency of one parent over the other the author states as follows:

"Generally the more distinct and uniform a species the more prepotent it is over less distinct and less uniform species. In conformity to this, the more complex a hybrid is, the less it shows of itself in combination with a pure variety of a pure species. Also, in conformity to this law, the more complex a hybrid is, the more variable among themselves are its pure seedlings. We may expect the male parent to more often control in appearance and quality in fruit and the female in vine; yet, if we designate it a general law, there will be found many exceptions."

Report of the horticulturist, R. A. EMERSON (*Nebraska Sta. Rpt. 1899, pp. 50–61*).—Outline of the horticultural work now being carried out at the station and of experiments which have been discontinued.

Experiments conducted for 8 years in the hybridizing and cross pollinating of cucurbits have resulted negatively. In hybridizing different varieties of watermelons with the pollen of pumpkins or squash, no immediate effect of the pollen was discernible on the form, color, or flavor of the fruit or on the size, shape, or color of seed.

New experiments are being undertaken with native ornamentals, cover crops for orchards, orchard cultivation, and in plant breeding.

Progress of commercial growing of plants under glass, B. T. GALLOWAY (*U. S. Dept. Agr. Yearbook 1899, pp. 575–590, pls. 3, figs. 6*).—The historical development and present status of commercial plant growing under glass is considered. It is estimated that about 10,000 commercial establishments in the United States are devoted to growing plants under glass, 1,000 of which are engaged exclusively or nearly so in the forcing of early vegetables which have a retail value of $4,500,000. The 9,000 commercial florists' establishments are estimated to have on an average 2,500 sq. ft. of glass each, or a total of 22,500,000 ft. The estimated value of these establishments is placed at 50 cts. per square foot of glass and the income to the producer at 50 cts. per square foot annually, or $11,250,000; and double this amount from the standpoint of the retailer. The retail value of the cut flowers sold is estimated at $12,500,000, distributed as follows: Roses, $6,000,000; carnations, $4,000,000; violets, $750,000, chrysanthemums, $500,000; miscellaneous flowers, including lilies, $1,250,000. The wholesale price of roses, carnations, and violets in the 4 principal cut-flower markets of the country for the years 1890–1899 has averaged $5.70, $1.51, and 92 cts. per hundred, respectively. The American Beauty rose is excluded from the above average on account of the high price it commands as compared with other varieties.

The percentage decrease in wholesale prices of roses, carnations, and violets in each of the cities of Chicago, Boston, Philadelphia, and New York during the past 5 years as compared with the preceding 5 years is shown in tabular form.

The Lafleur or English herbaceous graft, E. MARRE (*Prog. Agr. et Vit. (Éd. L'Est), 21 (1900), Nos. 14, pp. 420–427, figs. 8; 15, pp. 443–452, figs. 5*).—The nature, value, and technique of this graft for vines is discussed at considerable length, illustrations being given of the more salient features.

The graft does not change the species, E. BRINGUIER (*Mess. Agr., 5. ser., 1 (1900), No. 6, pp. 208–210*).—A controversial article.

Top grafting and irrigation, J. I. GRAHAM (*Fruit Growers' Assoc. Ontario Rpt. 1899, pp. 20–24*).—A practical paper on the apple, read before the association.

Winter cucumbers in pots (*Gard. Illus., 22 (1900), No. 1125, p. 397*).—A successful method for growing cucumbers in pots is detailed.

The forcing of lettuce (*Amer. Gard., 21 (1900), No. 306, pp. 727, 728*).—Concise cultural directions.

Growing rhubarb in the dark, S. S. BAILEY (*Rural New Yorker, 59 (1900), No. 2644, p. 655*).—The author reports the successful culture of rhubarb in a cellar. The roots were dug in the fall and allowed to freeze, after which they were placed in sand in the cellar and watered. The rhubarb was large enough for use by February 5. Brief suggestions regarding cooking rhubarb are added. Roots 3 or 4 years old are considered most satisfactory for forcing, and where a cellar is not available the roots may be placed in a box and covered with a barrel or other similar arrangement which will keep them in the darkness.

Experiments with tomatoes and potatoes, F. W. RANE (*New Hampshire Sta. Bul. 73, pp. 76–86, figs. 4*).—The importance of the tomato industry is noted and tabulated results given of tests of 15 of the newer varieties of tomatoes grown at the station in 1899 and 48 varieties grown in 1898 and before. The usual data as to the

average yield of ripe fruit per plant, date of first ripe fruit, average weight of green fruit, etc., are recorded and descriptive notes given of 20 varieties of tomatoes not previously mentioned in the station reports. Photographs are given of specimens of each of these varieties.

The report on potatoes shows the results obtained in a test of 47 varieties. The largest average yields for 3 years have been made by Late Puritan, Reeve Rose, Fillbasket, Seneca Beauty, Sir William, White Beauty, Breck Chance, Country Gentleman, Enormous, Harvest Queen, Red American Wonder—all yielding over 315 bu. per acre and mentioned in the decreasing order of their productiveness.

The tomato and its culture, M. Lecca (*Queensland Agr. Jour., 7 (1900), No. 3, pp. 229–232, fig. 1*).—Raising early plants, soil preparation, yields, and varieties are popularly considered.

Stripping bark from apple trees, N. O. Booth (*Rural New Yorker, 59 (1900), No. 2642, pp. 621, 622, figs. 6*).—Some inconclusive experiments are recorded in removing strips of bark 2 to 3 in. wide from the trunks of a Rambo and a Ben Davis apple tree. The effect of the gnawing of the bark by sheep is also noted. Stripping is a devitalizing process and is employed to throw trees into bearing. When the cambium is not harmed the wound soon heals over. Abrasions of the cambium result in more serious injury to the tree when they take a transverse rather than a longitudinal trend.

Some data are given on the effect of removing strips of bark from apple trees every 10 days from March 20 to July 20.

New plums, L. Burbank (*Rural New Yorker, 59 (1900), No. 2644, p. 655, figs. 4*).—Some new plums originated by the author are described.

Plantains and bananas, P. G. Wicken (*Jour. Dept. Agr. West. Australia, 1900, Aug., pp. 59–62*).—Notes on methods of culture and uses of these fruits.

Lemon culture in Italy, H. Dixon (*Agr. Gaz. New South Wales, 11 (1900), No. 9, pp. 719, 720, figs. 2*).—Methods of protecting the trees from the sun and frost by means of upright posts connected with horizontals and covered over with grass, straw, etc., are noted.

Lemon pruning (*Pacific Rural Press, 60 (1900), No. 14, p. 209, figs. 5*).—The Baronio method of pruning lemons is illustrated and described. It consists in cutting out the whole center of the tree, followed by cutting out the upright growing shoots or suckers and encouraging the growth of small shoots or fruiting spurs on a flat framework.

Orange-tree roots, J. H. Reed (*California Cultivator, 14 (1900), No. 21, pp. 321–323*).—The penetration of orange-tree roots in irrigated orchards is noted.

The persimmon in Iowa, F. O. Harrington (*Trans. Iowa Hort. Soc. 1899, pp. 251–256*).—The possibilities of persimmon culture in Iowa are pointed out, and detailed directions given for all the different operations connected therewith.

Growing strawberries in New England, F. W. Rane (*New Hampshire Sta. Bul. 74, pp. 88–106, figs. 6*).—Cultural notes, reprinted from a previous bulletin of the station (E. S. R., 10, p. 48), and the results of tests of varieties are given. Tabulated comparative data as to blooming period, first ripe fruit, yield, drought resistance, etc., are tabulated for 86 varieties tested in 1899. Descriptive notes are given on 10 of the more popular varieties and on 29 of the later introductions. The following varieties are considered of most merit: Beverly, Brandywine, Bubach, Clyde, Crescent, Greenville, Haverland, Lovett, and Warfield.

Eureka and Kansas raspberries, C. C. Nash (*Amer. Gard., 21 (1900), No. 302, p. 662*).—From the results obtained in comparative tests with the black raspberries in 1899, the author gives his preference to the Kansas variety. It produces plenty of strong, vigorous fruiting canes on either sandy or clay soil, and is more hardy than Eureka.

The alligator pear, D. Bois (*Rev. Hort., 72 (1900), No. 19, pp. 546, 547, pl. 1*).—This tropical fruit (*Persea gratissima*) is illustrated and notes given on its culture and uses.

India rubber, J. Parkin (*Indian Forester, 26 (1900), No. 7, pp. 313–329*).—Notes on the origin, collection, and preparation of India rubber.

Caoutchouc in German East Africa (*Tropenpflanzer, 4 (1900), No. 8, pp. 367–378*).—The report of the governor of German East Africa to the home office. Notes on culture experiments are recorded and some commercial data given.

Repeated tapping of Ficus elastica, A. Preyer (*Tropenpflanzer, 4 (1900), No. 8, pp. 404–406*).—Trees were tapped in one experiment at intervals of 7 to 10 days and the coagulated caoutchouc removed. The incisions were made close under each other. About 7½ times as great a product was thus obtained with 5 tappings as is usually obtained where only 1 tapping is practiced. In another instance the intervals between tappings were reduced to 3 and 2 days, respectively, and 3 tappings made. Again the product secured was nearly 3 times that secured with only 1 tapping. The repeated tapping is said not to hurt the trees as in some parts of the province of Subany, the practice of repeated tapping of the same trees has been carried on by the natives for years without harm.

Pecan groves, H. Rost (*Proc. Texas Farmers' Cong. 1900, pp. 130–138*).—Varieties to plant and the profits in growing pecans are considered.

Flower odors (*Wiener. Illus. Gart. Ztg., 8 (1900), No. 9, pp. 260–263*).—The classification of flower odors is considered. Deppino's classification of flower odors into sympathetic and idiopathic kinds is used as the basis of the author's remarks, many examples of the odors of flowers coming under the two headings being given.

Fall-sown asters (*Amer. Gard., 21 (1900), No. 302, p. 660*).—In experiments on the *American Gardening* trial grounds fall-sown aster seed withstood the rigor of winter and came up abundantly in the spring. The plantlets were transplanted into rows alongside of plants grown from spring-sown seed. The plants from spring-sown seed promised better in the early part of the season, but as they began to come into bloom they were attacked and destroyed by disease. The plants from the fall-sown seed seemed more robust, grew well, and blossomed, and up to the time of writing not a plant had been lost by disease. The results are considered suggestive for further experimentation.

Different methods of orchid culture (*Florists' Exchange, 12 (1900), Nos. 33, p. 789; 34, p. 824; 35, p. 848*).—Besides certain general principles and a discussion of the usual methods employed in the culture of orchids, the late methods of certain Belgian and French florists are discussed. The new feature consists in potting orchids in leaf mold, a little sphagnum being placed in the bottom of the pots to prevent the mold from washing through. Excellent results are reported by this method of culture, and the author recommends the method for trial in this country.

Orchids from seed, E. O. Orpet (*Amer. Gard., 21 (1900), Nos. 300, p. 634; 303, p. 680; 306, pp. 728, 729, fig. 1*).—Some of the precautions to be observed in growing orchids from seed are pointed out.

Sweet-pea culture, H. H. Gibson (*Farmers' Gaz., 59 (1900), No. 38, p. 743*).—The use of various manures in heightening the color of sweet peas is discussed and cultural directions given.

Sweet violets and their culture, R. Parker (*Garden, 58 (1900), No. 1506, pp. 246–248*).—Outdoor culture, winter forcing, and varieties for the open are discussed.

Hedges, wind-breaks, shelters, and live fences, E. P. Powell (*New York: Orange Judd Co., pp. 140.*).—A treatise on the planting, growth, and management of hedge plants for country and suburban homes.

School gardens, F. M. Powell (*Trans. Iowa Hort. Soc. 1899, pp. 141–149*).—A somewhat extended review of the purpose and development of school gardens in this and European countries.

School gardens, E. GANY (*Rpt. U. S. Com. Education, 1898-99, 1, pp. 1067-1084; transl. from Rein's Pedagogical Cyclopedia*).—Discusses the history of school gardens and gives detailed directions for their management and use.

Report of the committee on school gardens and children's herbariums for the year 1899, H. L. CLAPP (*Trans. Mass. Hort. Soc. 1899, pt. 2, pp. 255-280, pls. 7*).—A number of school gardens in Massachusetts are briefly described. Notes are given on the character of each and on the use of the gardens by the children. German school gardens are commented upon. Suggestions regarding prizes for school gardens, with a list of prizes and gratuities awarded for school gardens and herbariums in 1899, are added.

Gardening by the Columbia, Missouri, public schools, J. C. WHITTEN (*Amer. Gard., 21 (1900), No. 292, pp. 504-506*).—Notes on methods of nature study and window gardening at the school and on results obtained.

FORESTRY.

Forest reserves in the United States, H. GANNETT (*Nineteenth Ann. Rpt. U. S. Geol. Survey, 1897-98, pt. 5, pp. 400, pls. 110, figs. 2; abs. in Forester, 6 (1900), No. 3, pp. 55, 56*).—A preliminary statement is given of the forest areas of the United States, particular attention being given to their geographic and economic consideration. It is said that of the United States, exclusive of Alaska, 37 per cent of the entire area is wooded.

A summary is given of the available information of the estimated merchantable timber of various species occurring in the different States. Reports are given on several of the timber reserves as follows: Black Hills Forest Reserve, H. S. Graves; Bighorn Forest Reserve, F. E. Town; Teton and Yellowstone Forest Reserves, T. S. Brandegee; Priest River, Bitterroot, San Jacinto, San Bernardino, and San Gabriel Forest Reserves, J. B. Leiberg; Washington Forest Reserve, H. B. Ayres; Eastern Part of Washington Forest Reserve, M. W. Gorman; Forest Conditions of Northern Idaho, J. B. Leiberg; and Pine Ridge Timber, Nebraska, N. H. Darton.

Practical tree planting in operation, J. W. TOUMEY (*U. S. Dept. Agr., Division of Forestry Bul. 27, pp. 27, pls. 4, figs. 2*).—This bulletin describes some of the practical workings of the cooperation with tree planters begun by the Division in 1899 under the provisions of Circular 22 (E. S. R., 11, p. 745). In addition it describes the result of successful plantings in the past both for general and for special purposes. The form of tree-planting agreement which is entered into in all cooperative investigations is given and the plan explained at some length. Under this cooperative system applications for assistance were received from nearly every State in the Union, more than 90 per cent, however, coming from the treeless regions of Texas, Oklahoma, Kansas, Nebraska, and the Dakotas.

Some of the difficulties attending tree planting are mentioned. The chief object of the cooperative work of the Division is to assist tree

planters in overcoming these adverse conditions, and to aid in the establishment of plantations to the greatest possible value of their owners. A number of plantations are described, and working plans for others given. Suggestions are given for the care of nursery stock and methods to be followed for the successful transplanting of evergreens.

A catalpa plantation, located in the sandy valley of the Arkansas River in Kansas, is described at some length. This plantation consists of 440 acres planted with hardy catalpa, the first planting having been done in 1890 and the last in 1892. A measured portion of this plantation was estimated to contain timber of a gross value of $267.15 per acre as the result of a 10-year crop. If from this gross amount the expenses incurred as well as the interest on the gross investment be deducted, there will be found a net profit of $197.55 per acre. This profit can be considerably increased if only a portion of the trees be marketed each year for the next 10 years.

Pure woods or mixed woods, W. SCHLICH (*Gard. Chron., 3. ser., 27 (1900), No. 696, pp. 257, 258*).—The author gives the results of his investigations on the subject of pure and mixed forests. The species of trees suitable to be grown in pure woods are beech, hornbeam, silver fir, spruce, sycamore (*Acer pseudoplatanus*), white pine, and Douglas fir. Those doing best in mixed forests are larch, birch, poplar, ash, oak, and chestnut. The author states that only species which are capable of preserving the yield capacity of the locality should be used in pure woods. In the case of mixed woods one of the species of the mixture must be a soil-improving one, and it should be more numerous than the others. As a rule not more than 2 or 3 species should be mixed on the same area unless placed in separate groups, representing a series of small pure woods. Shade-bearing species may be mixed with each other, provided their rate of growth in height is the same; but the slower growing must be protected against the other tree by giving it the start or cutting away the threatening individuals of the faster-growing species. Shade-bearing and light-demanding species may be mixed if the latter are the faster growing or have been given the start. Light-demanding species should not be mixed with each other except in very fertile localities, in inferior localities where nothing else will grow, in temporary mixtures where one is used to protect another, or if the wood is treated under very short rotation. Whether the mixture should be arranged by single trees or whether each species should form separate groups depends upon various circumstances, the principal of which is the relative height growth and shapes of the different trees.

Observations on the temperature, growth, and moisture content of various trees, W. R. LAZENBY (*Proc. Soc. Prom. Agr. Sci., 1899, pp. 35–42*).—A report is given on observations made to determine

the variations in temperature of trees in which the temperature of oak and pine trees of different diameters were compared with the temperature of the open field. The author reports a variation of about 4° F. between the temperature of the open field at a distance of 10 rods from the temperature readings of a narrow strip of woodland where these experiments were conducted. The readings of the different thermometers for the month of February are given and comparisons made with temperatures taken from apple trees in another series of investigations. The records show that the temperature of trees of the smaller diameter follow more nearly that of the atmosphere than in the case of the larger trees. The temperature of the trees did not respond to slight variations in the external temperatures and never reached the same maxima and minima as shown by the thermometers in the open air. Decided variations in the temperature of the open air were followed by similar variations in the internal temperature of the trees in from 24 to 72 hours, depending largely upon the diameter of the trees.

The second part of the paper reports a summary of results of observations to determine the amount of growth made by a series of trees during the growing season of 1898. The moisture content of the same trees was determined at the same time. The trees investigated were the American elm, black walnut, Carolina poplar, magnolia, red oak, sugar maple, and white ash. All these trees were 10 years old, with the exception of the Carolina poplar, which was 6 years old. In height the trees varied from 15 to 25 ft., and in diameter from 3 to 5 in. Measurements were made of the upright, terminal, and lateral branches, and are recorded in tabular form. The percentage of moisture in the same trees was determined, in which it is shown, as would naturally be expected, that the softer woods contained the highest percentage of moisture.

The production of high-class oak, ash, and larch timber, W. SCHLICH (*Gard. Chron., 3. ser., 27 (1900), No. 697, pp. 274, 275*).—Suggestions are given for the proper management of these species for the production of timber in England. All are light demanding, are thin crowned, and none of them improve the yield capacity of the locality if raised in pure woods. The best way of rearing them is said to be to mix them with the shade-producing, full-crowned species. The species best adapted for this purpose is said to be beech.

Oak and beech mixtures and ash and beech mixtures are described at some length. The growing of larch and beech is of particular importance since the larch disease has spread throughout Great Britain. Oak, ash, and larch woods may be under planted with silver firs instead of beech. Scotch pine has been used with favorable results in the same way.

Progress of forestry in the United States, G. PINCHOT (*U. S. Dept. Agr. Yearbook 1899, pp. 293–306, pls. 4, map 1*).—The early attitude of the inhabitants of this country toward forestry is indicated. The development of the forestry policy of the Government is traced, and the administration of the national forest work and national parks described. Notes are given on private and State forestry, and forest-fire legislation. The establishment and work of the Division of Forestry of this Department are described and some of the lines of investigation mentioned. Attention is briefly called to forest associations and institutions of the United States offering instruction in forestry. Arbor day as a factor in influencing respect for trees and preparing a sentiment for practical forestry is mentioned.

Progress in tree planting in the United States, J. W. TOUMEY (*Forester, 6 (1900), No. 9, pp. 213, 214*).—In a paper read before the American Forestry Association in New York, June 25, the author briefly reviewed the work of the Division of Forestry of this Department, explaining the plans for cooperation, by which practical assistance is given to farmers and other landowners in establishing plantations of forest trees for economic purposes.

North American forests and forestry, E. BRUNCKEN (*New York: G. P. Putnam's Sons, 1900, pp. 265*).

The practice of forestry by private owners, H. S. GRAVES (*U. S. Dept. Agr. Yearbook 1899, pp. 415–428, pls. 4*).—The general movement in the United States in favor of conservative forestry is said to have begun about 25 or 30 years ago. The early efforts of private owners to preserve forests are described, the systems having been devised by the owners themselves. In many cases these systems could be materially improved, but the results show that more has been done in the way of forestry in this country than is generally supposed. Forest management under systematic working plans is described, and methods for forest planting and controlling forest fires are given.

Technical exploitation of forests, H. VANUTBERGHE (*Exploitation technique des forêts. Paris: Gauthier-Villars, 1900, pp. 176*).

Statistical report on the growth and development of various conifers in Schovenhorst, etc., J. H. SCHOBER (*Berlin: Julius Springer, 1900, pp. 34*).

Ancient pollard oaks (*Garden, 57 (1900), No. 1479, p. 217, figs. 3*).—Notes are given on 3 pollard oaks which are thought to be 1,800 years old. The trees measure 20 ft. 9 in. and 28 ft. 4 in. in circumference at the smallest portion of their trunks.

Reproduction of timber in the black-jack forests of Oklahoma, W. L. HALL (*Forester, 6 (1900), No. 7, p. 164*).—Notes the rapid reforestation of former areas covered with this oak. Associated with it are often found other oaks, hackberry, white elm, etc. Hardy catalpa, black locust, and black walnut have been successfully introduced among the natural forest growth.

Extermination of the red cedar in Oklahoma, W. L. HALL (*Forester, 6 (1900), No. 7, p. 163*).—Notes the almost total extermination of a former abundant red cedar crop by cutting for posts and removal of young trees for ornamental purposes. It is said that at least 99 per cent of the latter died as a result of the transplanting.

Some timber trees of Queensland, J. W. FAWCETT (*Queensland Agr. Jour., 6 (1900), No. 4, pp. 313–315*).—Descriptive notes are given on *Angophora subvelutina*, *A. intermedia*, and *A. lanceolata*.

Notes on the timber trees of the Burnett district of Queensland, J. W. FAWCETT (*Queensland Agr. Jour., 6 (1900), Nos. 5, pp. 396–399; 6, pp. 505–508*).—Brief notes are given on 63 species of timber trees and the characteristics and uses of the timber are pointed out.

Fires in the forests of Pinus maritima, E. MUEL (*Jour. Agr. Prat., 1900, I, No. 17, pp. 598–600*).—A tabular summary is given of the destruction done by forest fires in the maritime provinces of France. In 1899 over 13,900 hectares were burned over, at an estimated loss of 1,665,470 francs.

The composition of cork oak and its bearing on forestry, E. GIUSTINIANI (*Jour. Agr. Prat., 1900, I, No. 21, pp. 743-745*).—Analyses are given of the bark and wood, and of the ash of bark, wood, roots, leaves, and acorns of the cork oak, and the bearing these analyses have upon forests and forest planting.

The Robinia and its exploitation, P. MOUILLEFERT (*Jour. Agr. Prat., 1900, I, Nos. 16, pp. 578-581; 17, pp. 603-605, fig. 1*).—Notes are given on the value of *Robinia pseudacacia* for forest planting.

On the working qualities of some colonial timbers, H. STONE (*Agr. Jour. Cape Good Hope, 17 (1900), No. 4, pp. 217-225*).—A report is given of the results of a series of technical tests of a number of species of indigenous and introduced timbers.

Growing Norway spruce for paper pulp, T. L. DUNCAN (*Amer. Gard., 21 (1900), No. 296, pp. 567, 568*).—The author recommends the growing of Norway spruce (*Picea excelsa*) for paper pulp manufacturing. Data are given on the rate of growth of a number of lots of this spruce in Minnesota, and under proper conditions of culture and fire protection it is believed that it would furnish a crop suitable for wood pulp in from 25 to 30 years, a period much less than the time required for the growth of the ordinary white and red spruce.

A suggestion for the estimation of cord wood, G. F. SCHWARZ (*Forester, 6 (1900), No. 4, pp. 76-78*).—The author explains a system of estimating cord wood in standing forests, which method is known in Europe as the "absolute factor of shape." It is considered a very accurate one and has been employed extensively in Denmark with entire satisfaction. In a beech and oak forest in Germany this method was tested and proved more accurate than measurements made by other systems. The method is believed to possess certain advantages over the others and to be adaptable to the varying conditions of American forests.

Practical estimation of timber, P. MOUILLEFERT (*Jour. Agr. Prat., 1900, I, No. 12, pp. 427-430*).—Formulas are given for the estimation of wood and timber in forests.

Railroad forestry, J. H. SUTOR (*Sci. Amer. Sup., 50 (1900), No. 1286, pp. 20619, 20620*).

Means for preventing worm holes in timber, E. MER (*Jour. Soc. Agr. Brabant-Hainaut, 1899, pp. 434, 435*).

Fireproofing wood (*Sci. Amer., 83 (1900), No. 4, pp. 49-55, figs. 4*).—A description is given of a method of fireproofing wood for building purposes.

SEEDS—WEEDS.

Twenty-first annual report of the Swiss seed control station at Zurich, F. G. STEBLER, E. THIELÉ, and A. VOLKART (*Landw. Jahrb. Schweiz, 14 (1900), No. 1, pp. 48, figs. 2*).—A report is given of the activities of the station during the year ended June, 1899. During this period 8,473 samples of seed were tested, the investigations requiring 21,274 tests. These trials served as the basis of a guarantee for about 350,000 kg. of clover and grass seed. Most of the samples of seed tested for consumers were found in excess of the guarantee, few, if any, falling below the difference allowed by the regulations of the station.

A tabular statement is given showing the result of the year's tests of different seeds, and also the average percentage of purity, germination, and intrinsic worth of all seed examined since the establishment of the station. Detailed statements are also given of the tests of clover and grass seeds and grass seed mixtures.

Experiments are briefly reported in which is shown the comparative value of crops grown from seeds of different origin. Timothy from American seed gave a slightly larger yield than that from German seed. Alfalfa from American seed yielded least of 4 kinds. Alfalfa from different parts of Russia varied widely in the quantity of green fodder produced. The relative yields of orchard grass from forest-grown and field-grown seed were tested, to the decided advantage of the field-grown seed. Comparisons were made between the yields of American, New Zealand, French, and Swiss grown orchard grass, in which the yields secured for 3 years are shown. Except for the New Zealand seed, which was considerably lower than the others, there was but little difference in the different lots.

Notes are given on the weed seeds found in alfalfa seed from different countries, especial attention being paid to *Cuscuta racemosa*, a South American dodder which is said to occur in seed from that country.

The time required for the germination of seed of *Pinus sylvestris* was investigated. Different lots of pine seed which showed varying degrees of vitality were tested, the sprouted seeds being counted on the sixth, ninth, twelfth, fifteenth, twenty-first, and thirtieth days. It was found that of the germinable seed of the different lots, all but about 10 per cent sprouted within 15 days.

Effect of formaldehyde on the germination of cereals and on smut spores, S. David (*Sitzber. Naturf. Gesell. Univ. Dorpat, 12 (1899), No. 2, pp. 202–204, 222–247*).—Investigations are reported showing the effect of formaldehyde upon the germination of wheat, maize, oats, and barley and upon the spores of smuts of these cereals. Different lots of seed were subjected to varying strengths of formaldehyde solutions for 1, 3, 6, 12, 18, and 24 hours, after which their germination was tested. The strengths of solutions used were 0.025, 0.05, 0.125, and 0.25 per cent of formaldehyde, and comparisons were made with equal quantities of seed soaked in distilled water for equal lengths of time. The effect of formaldehyde vapors was tested in a similar manner.

The results of the experiments are shown in tabular form, from which the effects of the treatments of seed upon their germination may be seen. An injurious effect is noted upon different cereals, being most marked in the experiments with oats. The extent of injury is in proportion to the strength of solution and time of soaking. The injury is manifested in retarded germination, in abnormal germination in which no roots were produced although the seeds sprouted, and in dead seed. The action of the solutions on the spores of smuts was quite marked, a few hours' treatment destroying the spores of *Ustilago avenæ*, *U. hordei*, *U. maydis*, and *U. destruens* adhering to the treated seed. After treating the seed the injurious effects of formaldehyde may be diminished by soaking the seed in a weak solution of ammonia for 15 minutes.

Seed selling, seed growing, and seed testing, A. J. PIETERS (*U. S. Dept. Agr. Yearbook 1899, pp. 549–574, pls. 5, fig. 1*).—The beginning and development of the seed industry in the United States, the methods of seed growing of different kinds, the regions and conditions favorable for profitable seed growing, and seed testing are described. The methods of seed testing pursued by different commercial seedsmen and those followed by this Department are outlined.

Technical regulations of the Association of German Agricultural Experiment Stations for seed testing (*Landw. Vers. Stat., 54 (1900), No. 1–2, pp. 91–100*).—The rules relative to samples, sampling, and testing are given.

The after-ripening of oats, W. KINZEL (*Landw. Vers. Stat., 54 (1900), No. 1–2, p. 133*).—A report is given of tests of the germination of oats at bimonthly periods after harvesting. The percentage of germinable seed was found to steadily increase for 8 to 10 months, after which there was a decrease.

Canada thistle, L. H. DEWEY (*U. S. Dept. Agr., Division of Botany Circ. 27, pp. 14, figs. 4*).—Illustrative and descriptive notes are given on the Canada thistle, in which its history, introduction, present range, and methods of distribution are discussed in greater or less detail. Numerous methods of eradication are suggested, the success of any of them depending upon the thoroughness with which it is carried out.

DISEASES OF PLANTS.

The diseases of beet seeds and means for combating them, LINHART (*Oesterr. Ungar. Ztschr. Zuckerind., 1899; abs. in Ztschr. Pflanzenkrank., 10 (1900), No. 2, pp. 116, 117*).—A number of fungus and bacterial diseases of beets that seem to be communicated through the seeds are described. The bacterial disease is attributed to *Bacillus mycoides*. Associated with it were found *Bacillus subtilis*, *B. fluorescens liquefaciens*, and *B. mesentericus vulgatus*. *B. mycoides* is considered the cause of the disease commonly known as bacteriosis and also that on young plants known as black shank. The fungus diseases found were those caused by *Phoma betæ* and *Pythium debaryanum*.

As a means for preventing these diseases it is recommended that the "seed" be soaked for 30 minutes in concentrated sulphuric acid, after which they are washed for 10 minutes in a strong stream of running water and then soaked 2 hours in milk of lime and washed 4 hours in water. This treatment does not injure the seed, while it destroys all spores adhering to the hard seed coat.

Bacteriosis of beet roots, A. STIFT (*Oesterr. Ungar. Ztschr. Zuckerind., 1899, p. 605; abs. in Jour. Roy. Micros. Soc. [London], 1900, No. 3, p. 373*).—A description of diseased beets and results of inoculation experiments with cultures of *Bacillus betæ* are given. The bacillus was cultivated on agar. It is about 4 μ long by 0.9 to 1 μ broad. Its ends are rounded and in hanging drops actively motile. Flagella are numerous and very delicate. In cane-sugar-meta-peptone gelatine sugar was completely decomposed without the evolution of gas, a fact, it is said, which suggests that the conversion of sugar was due to hydrolysis. The organism liquefies gelatine and on agar slants presents a slight irregular growth.

An inquiry into the cause and nature of crown gall, J. W. TOUMEY (*Arizona Sta. Bul. 33, pp. 64, figs. 31*).—This bulletin is a continua-

tion of investigations reported upon in the Annual Report of the station for 1899 (E. S. R., 11, p. 858). The previous publications relating to this disease are briefly reviewed and the geographical distribution in the United States outlined. The various field experiments that have been conducted by the author are reviewed at considerable length, together with his inoculation experiments. The investigations of the author seem to indicate the parasitic nature of the disease and its ready transmission in the soil or by means of inoculation experiments.

The crown gall, in the author's observations, has been noted upon the peach, apricot, almond, prune, plum, apple, pear, English walnut, and grape, and it is reported by others to occur on the raspberry, blackberry, cherry, poplar, and chestnut.

The crown gall, according to the author, is annual in its period of growth, beginning in the spring and maturing in the fall. However, in Arizona galls sometimes develop late in the summer and continue their growth throughout the winter when the normal tissues of the tree are dormant. At first appearance the galls appear as a clear, white, translucent mass of soft, succulent tissue, a millimeter or less in diameter and nearly or quite spherical. It is most frequently attached to the host by a narrow neck $\frac{1}{2}$ to $\frac{1}{4}$ of the body of the gall. When grown above ground or in water cultures, so as to have access to light, the galls change to a light green from the development of chlorophyll in their outer cells. At first the gall has a rather uniform outer surface, which becomes warty after a time from unequal growth. The white appearance of the gall is lost early in its life and the outgrowth becomes a reddish brown. Any portion of the gall which has changed color has lost the power of further growth. When the galls decay, as is usually the case at the end of the season's growth, it leaves an open wound through the bark which extends some distance into the wood. The following spring a more or less interrupted circle of gall tissue forms around the wound caused by the gall of the previous year. The galls become larger and deeper each succeeding year until finally the stem becomes so weakened that the tree breaks off.

The cause of the crown gall, in the author's estimation, is due to a specific organism belonging to the slime molds to which the name *Dendrophagus globosus* is given. The various stages of the parasite are described at considerable length and a number of successful inoculation experiments, in which sclerotia were used, are described. The effect of the parasite on its host is noted and the various phases through which the organism passes are described.

The organism which is considered new, both generically and specifically, is described as follows:

"Plasmodium parasitic; peridial wall brittle, nonpersistent, shining, breaking in straight lines into small irregular pieces; capillitium fragmentary, formed of a few irregular, branching tubules attached to the lower portion of the peridial wall.

"Sporangia sessile, occurring singly or in groups of 2 or 3, 1 mm. or less in diameter, globular or slightly flattened and resting directly upon the tissue of the host, deep orange, shining, opening irregularly; peridium thin, minutely granular when highly magnified, the interior surface more or less covered with yellow protoplasmic nodules of variable size and refractive power; capillitium of a few thick, blunt, sparingly branched, and irregular nodular hollow threads; spores orange yellow, adhering in masses, smooth, $1\frac{1}{2}$ to 3 μ in diameter."

Its affinities with Plasmodiophora, which causes club root, are indicated, comparisons being drawn between this organism and some recent studies by Nawaschin on Plasmodiophora.

But little is known concerning the remedies for this disease aside from negative results. The author's and others' investigations have shown that sulphur is of no avail as a remedy. From the position and character of the disease it seems evident no remedy will completely overcome it after an orchard is once attacked. The safest advice is to see that young trees when planted in orchards are not infested and have not come from known infested nurseries. Where the disease has established itself in an orchard, the life of the trees may be prolonged for a time by cutting off the galls from the crowns of the roots and covering the injury with a mixture of copper sulphate and lime in the form of a thick paste.

Stigmonose: A disease of carnations and other pinks, A. F. Woods (*U. S. Dept. Agr., Division of Vegetable Physiology and Pathology Bul. 19, pp. 30, pls. 3, figs. 5*).—Previous publications by the author on this same subject have been noted (E. S. R., 9, pp. 657, 852). In the present bulletin the investigations of Arthur and Bolley on this disease have been thoroughly reviewed and no evidence found that this disease is of bacterial origin. A full account is given of the investigations conducted by the author, in which he found that the primary cause of the disease was due to punctures made by aphides and thrips, while another form of the disease is commonly caused by injuries produced by red spiders. The effect of the disease on the plant as a whole depends upon its vigor and the number of punctures, and the susceptibility of different varieties to injury seems to be, as a rule, proportionate to the normal vigor of the variety. Methods are suggested for controlling the disease which can be successfully done by the proper selection of cuttings, careful propagation of stock, good soil, proper amount of moisture, light, and air, and by the reduction of aphides, thrips, and red spiders to a minimum.

Progress in the treatment of plant diseases in the United States, B. T. Galloway (*U. S. Dept. Agr. Yearbook 1899, pp. 190–200, figs. 2*).—A review is given of the work for the past century on the treatment of plant diseases, from which it appears that the greatest progress has been made within the past 15 years. The beginnings of modern research are placed at about 1870, since which time great activity has taken place both in the United States and abroad. The period between 1888 and 1895 is characterized as an epoch-making one on account of the rapid strides made in discovering the causes of plant diseases and methods for their prevention.

Some results of the work which have been obtained in this country are briefly outlined, examples being cited in grape diseases, nursery stock diseases, diseases of cereals, etc.

The diseases of cultivated plants, V. PEGLION (*Le malattie crittogamiche della piante coltivate. Casali: Carlo Cassone, 1899, pp. VII+311*).

Plant diseases investigated at St. Petersburg in 1898, K. S. IWANOFF (*Ztschr. Pflanzenkrank., 10 (1900), No. 2, pp. 97–102*).—A brief report is given on 160 species of fungi which were observed on 230 species of host plants. They are classified by hosts as follows: Cereals and grasses, clovers and legumes, potatoes, garden plants, fruit trees, berries, ornamentals, forest trees, and weeds. Among the number of fungi were several new species.

Parasitic algæ and fungi of Java, III, M. RACIBORSKI (*Batavia: Staatsdruckerei, 1900, pp. 49*).

A monograph of the Erysiphaceæ, E. S. SALMON (*Mem. Torrey Bot. Club, 9 (1900), pp. 1–292, pls. 9*).—A monograph of the species of powdery mildews is given, together with notes upon their morphology and life history, relation of host and parasite, and the distribution of the powdery mildews. The author limits the family to the genera Podosphæra, Sphærotheca, Uncinula, Microsphæra, Erysiphe, and Phyllactinia. Of these, 49 species and 11 varieties are recognized. Under the discussion of the various species notes of their economic importance are given. The species of Oidium are considered as conidial forms and for the most part are not described.

Concerning the geographical distribution of rust fungi, P. DIETEL (*Naturw. Wchnschr., 15 (1900), No. 19, pp. 217–220*).

The depreciation of the yield of wheat due to rust, A. GRÉGOIRE (*Bul. Sta. Agron. Gembloux, 1900, No. 67, pp. 14, 15*).—An account is given of pot experiments conducted to determine the loss due to rusts of cereals. Six series were grown, in which the loss of straw was from 8 to 23 per cent, with an average of 17 per cent, and in grain the depreciation was from 21 to 40 per cent, with an average of 35 per cent. The number of grains per head and average weight of the individual grain was considerably lower for the plants affected with rust.

Recent investigations on rust of wheat, W. G. SMITH (*Nature, 62 (1900), No. 1606, pp. 352–356, figs. 2*).—A review is given of the recent publications of Eriksson, Klebahn, Carleton, and others on rusts of cereals.

Investigations of the rust fungi of cereals in Austro-Hungary, H. ZUKAL (*Ztschr. Pflanzenkrank., 10 (1900), No. 1, pp. 16–21*).—A report is given of studies on the cereal rusts of Austro-Hungary. The species observed were *Puccinia graminis* on rye, *P. glumarum* on wheat, *P. simplex* and *P. graminis* on barley, and *P. graminis* and *P. coronata* on oats. The author tentatively adopts the name *P. glumarum* for the rust on wheat. Culture experiments were made of the different species, and negative results were obtained in experiments for preventing the attacks of rusts. In relation to Eriksson's mycoplasma theory the author is led to believe some infection may possibly be secured through mycelium carried in the seed grain. Investigations on alternate generations showed that the rust fungi are not confined to certain definite transition hosts for their phases.

Experiments with smuts of cereals, C. N. GRENFELL (*Agr. Gaz. New South Wales, 11 (1900), No. 9, pp. 742–747*).—Inoculation experiments are reported with *Tilletia tritici*, *Urocystis occulta*, and *Ustilago segetum*. Soaking seed in copper sulphate as a means of preventing smuts was successfully investigated, the treatment tending to reduce the amount of disease. It is claimed that *Ustilago segetum* decreases and *Urocystis occulta* increases the tillering tendency of wheat plants. The infection of the loose smut, *U. segetum*, is said to take place at an earlier stage of the plant than the others, probably occurring in the seed.

Infection experiments with some Uredineæ, E. FISCHER (*Bot. Centbl., 83 (1900), No. 3, pp. 75, 76*).—Successful inoculations of *Actæa spicata* with teleutospores of a

Puccinia from *Triticum caninum* are reported, from which it is claimed the *Æcidium actæa* is to be associated with a Puccinia of the type of *P. persistans* on *Triticum caninum*. Basidiospores of *Puccinia buxi* sown upon young box leaves gave positive results. The infection was one month in becoming manifest, and the teleutospores were formed the following year.

Blight of maize, J. MARWICK (*Agr. Jour. Natal, 3 (1900), No. 11, pp. 321-323*).—A popular account is given of a disease of maize due to some apparently unknown cause. The affected plants are stunted in growth, have stripped leaves, and are generally worthless.

The diseases of the sugar beet, A. STIFT (*Die Krankheiten der Zuckerrübe. Vienna: W. Frick, 1900, pp. VIII+115, pls. 15*).

A contribution to the bacterial disease of sugar beets, A. STIFT (*Ztschr. Pflanzenkrank., 10 (1900), No. 1, pp. 5-15, figs. 2*).—An account is given of a bacterial disease of sugar beets, a description of the organism isolated, and its effect as shown by inoculation experiments and analyses of diseased roots.

The heart rot of beets, J. PARFONDRY (*Jour. Soc. Roy. Agr. L'Est., Belg., 1900, p. 226*).

A new disease of radishes, G. R. B. VON MANNAGETTA (*Sitzber. Deut. Naturw. Med. Ver. Böhmen-Lotos, 1899, No. 8, pp. 3*).

Diseases of the potato and their treatment, H. POTEL (*Bol. Inst. Agron. Sao Paulo, 10 (1900), No. 11-12, pp. 795-799*).

The yellow blight of potatoes (*Agr. Gaz. New South Wales, 11 (1900), No. 8, p. 683*).—A brief quoted reference to this disease in Ireland is given. It is said to be accompanied by the stalk disease due to *Peziza postuma* and a root rot, neither of which is characterized.

Results of seed treatment of potatoes, H. KOCH (*Deut. Landw. Presse, 27 (1900), No. 25, p. 295*).—Seed tubers of 4 varieties were soaked for 24 hours in Bordeaux mixture before planting. The plants from the treated seed were 3 or 4 days later in coming up than the untreated, but were stronger and more healthy. A considerably increased yield, attributed to the treatment, is recorded for all the varieties.

On the prevention of potato rot, T. RITTER VON WEINZIERL (*Pub. K. K. Samen-Control Sta. Wien, No. 199, pp. 3-5*).—Spraying with Bordeaux mixture, 2 kg. copper sulphate, 2 kg. lime, and 100 liters water is recommended. Three applications are advised.

A nematode disease of rye, L. MANGIN (*Jour. Agr. Prat., 1900, I, No. 20, pp. 707, 708*).—Describes a disease of rye due to *Tylenchus devastatrix*. The nematodes produce bulb-like enlargements of the roots. Rotation of crops is recommended as the most favorable means of prevention.

The life history of the tobacco nematode (Heterodera radicicola) and its destruction, J. VAN BREDA DE HAAN (*Bul. Inst. Bot. Buitenzorg, 1900, No. 4, pp. 1-10*).

Notes on some galls produced by Heterodera radicicola, M. MOLLIARD (*Rev. Gén. Bot., 12 (1900), No. 135, pp. 157-165, pl. 1, fig. 1*).—Histological structures of galls on melons, coleus, etc., are described.

Nematodes and ammonium salts, H. D'ANCHALD (*Jour. Agr. Prat., 1900, I, No. 20, pp. 711, 712*).—Gas liquor and solutions of chlorid and nitrate of ammonia are said to be destructive to nematodes and the efficiency of the treatment lasts over 2 years. In order that all nematodes should be destroyed repeated applications, extending over several years, are recommended.

A new method of combating nematodes, H. WILFARTH (*Ztschr. Ver. Deut. Zuckerind., 1900, No. 529, II, pp. 195-204*).

Demonstration of crown gall contagion (*Pacific Rural Press, 59 (1900), No. 21,*

p. 321, figs. 7).—Results of experiments by J. W. Toumey of the Arizona Station p. 458).

The scab disease of apples, pears, etc., and its treatment, WEISS (*Prakt. Bl. Pflanzenschutz, 1900, No. 2, pp. 9–11*).

Apple mildew, P. MAGNUS (*Centbl. Bakt. u. Par., 2. Abt., 6 (1900), No. 8, pp. 253–255, figs. 2*).—A discussion as to the specific relationship of the fungus causing apple mildew. The author doubts the occurrence of *Sphærotheca mali* on apple trees. As a preventive the author speaks very highly of sulphur.

Means of protection from the so-called scab of pomaceous fruits, FRANK (*Sep. Arb. K. Gesundheitsamte, Biol. Abt., 1900, pp. 4, fig. 1*).

Canker in fruit trees and its treatment (*Garden, 57 (1900), No. 1478, pp. 197, 198*).—A translation of an article treating of the attack of *Nectria ditissima* with suggestions for its prevention.

Leaf curl in peaches and nectarines (*Garden, 57 (1900), No. 1479, p. 224, figs. 2*).—Notes on *Exoascus deformans* and suggestions for its prevention.

The shot-hole fungus (*Garden, 57 (1900), No. 1480, p. 245, figs. 8*).—Figures and describes the shot-hole fungus *Cercospora circumcisca.*

The biology and practical suggestions for combating hexenbesens in cherry trees, C. FREIHERR VON TUBEUF (*Arb. K. Gesundheitsamte, Biol. Abt. Leaflet 4, 1900, pp. 4, figs. 4*).

Witches brooms of Pinus sylvestris, A. W. BORTHWICK (*Trans. and Proc. Bot. Soc. Edinburgh, 21 (1900), pp. 196, 197*).

Some citrus troubles, H. H. HUME (*Florida Sta. Bul. 53, pp. 147–173, pls. 6, figs. 5*).—The author describes foot rot, scab, dieback, sooty mold, blight, melanose, and leaf spot—diseases of citrus fruits—and the injuries caused by the presence of lichens and moss upon the trees. Most of these diseases have been previously described in U. S. Dept. Agr., Division of Vegetable Physiology and Pathology Bul. 8 (E. S. R., 8, p. 58), and the recommendations there given for the prevention of the diseases are repeated. The leaf spot disease is described as being slightly injurious to orange trees in some parts of the State. Large, somewhat circular, yellowish spots are noticed upon the leaves which are attributed to *Colletrotrichum glœosporioides.* Spraying trees with ammoniacal solutions or Bordeaux mixture is recommended. The injury done by lichens and moss (*Tillandsia usneoides*) is mentioned and the destruction of the lichens by spraying with strong Bordeaux mixture is recommended, while the moss may be removed by pulling it from the trees.

Collar rot or mal-di-gomma of citrus trees (*Agr. Gaz. New South Wales, 11 (1900), No. 8, pp. 660–668*).—This disease, which is also commonly known as foot rot, is due to *Fusarium limonis.* The symptoms of the disease, conditions favoring its spread, means for its prevention, and history of the disease in Australia are given. The treatments recommended in U. S. Dept. Agr., Division of Vegetable Physiology and Pathology Bul. 8 (E. S. R., 8, p. 58), are suggested as means for prevention.

Chlorosis of fruit trees, C. BOUILLOT (*Semaine Hort., 1900, pp. 23, 35, 36, 59, 60, 95*).

Chlorosis of the vine, G. CURTEL (*Compt. Rend. Acad. Sci. Paris, 130 (1900), No. 16, pp. 1074–1076; abs. in Jour. Roy. Micros. Soc. [London], 1900, No. 4, pp. 488,489*).—The physiological injuries inflicted by chlorosis of the grape have been investigated and it is shown that there is an evident weakening of the respiratory activity, a diminution in the proportion of gases exchanged, a diminution and final cessation of assimilation, and a great weakening of the functions of transpiration. The appearance of chlorosis and the lowering of the transpiratory function appear to be indissolubly connected.

Notes upon grape mildew, B. D. HALSTED (*Asa Gray Bul., 8 (1900), No. 4, pp.*

78, 79).—Notes on the occurrence of *Plasmopara viticola* on grapevines at the New Jersey Experiment Station.

Permanganate of potash for grape mildew, A. SIMÉON (*Prog. Agr. et Vit. (Éd. L'Est), 21 (1900), No. 36, pp. 327, 328*).—The addition of 50 gm. of permanganate of potash to a hectoliter of Bordeaux mixture is said to increase the efficiency of the fungicide when used in combating grape mildew.

Practical instruction in combating Peronospora, A. BIZZOZERO (*Instruzioni pratiche per combattere la peronospora. Parma: Rossi-Ubaldi, 1900, pp. 29*).

The California vine disease in Avellino, C. CASALI and T. FERRARIS (*Giorn. Vit. e Enologia, 7 (1900), pp. 10, pls. 2*).

Brown spot diseases of grapes and Plasmodiophora vitis, J. BEHRENS (*Sep. Weinbau u. Weinhandel., 1899, No. 33, pp. 2*).

Grape scald, L. DEGRULLY (*Prog. Agr. et Vit. (Éd. L'Est), 21 (1900), No. 32, pp. 189, 190, pl. 1*).—A serious affection of grapes is reported in which the fruit and leaves are injured. They present some of the characteristics of grapes in the last stages of black rot, white rot, etc. The cause of the trouble is thought to be the unusual hot weather. In some parts of France the grape crop which had been especially promising is very seriously injured and less wine will be made than last year.

Some injuries to grapes, E. BRINGUIER (*Mess. Agr., 5. ser., 1 (1900), No. 8, pp. 301–319*).—Notes are given on a number of injuries to which grapes are subject, such as freezing, malnutrition, fungi, etc.

A stunted condition of grapevines, L. RAVAZ (*Prog. Agr. et Vit. (Éd. L'Est), 21 (1900), No. 21, pp. 608–610, pl. 1*).—Under the name "cabuchage" the author describes a diseased condition of grapes which he says is the same as court-noué—a stunted growth due to a number of causes.

Stunted growth (court-noué) of vines, L. RAVAZ (*Prog. Agr. et Vit. (Éd L'Est), 21 (1900), No. 24, pp. 694–703, pl. 1, figs. 12*).—This is essentially the same article as that noted from another source (E. S. R., 12, p. 260). The author states that variegation is a common accompaniment of the disease.

The successful prevention of grape diseases, W. SEELIG (*Proskauer Obstbau-Ztg., 1900, No. 4, pp. 49–51*).

Diseases of chestnuts in Savoy and Valais, L. CRIÉ (*Bul. Min. Agr. [France], 19 (1900), No. 1, pp. 120–134*).—A report on observations in these two regions on the various causes of disease and injury to chestnuts. A number of fungi are reported as causing great injury, among them are *Agaricus melleus*, *Torula exitiosa*, *Phyllosticta maculiformis*, *Polyporus sulphureus*, etc.

A disease of Tradescantia, A. HOWARD (*Ann. Bot., 14 (1900), No. 53, pp. 27–38, pls. 2*).—A rather severe attack of *Tradescantia zebrina* and *T. fluminensis* in greenhouses is reported. Dead leaves and stems covered with fungi as well as numerous dark spots and patches were abundant. Among the fungi was a species of Botryosporium. Inoculation experiments were successfully carried on, the mycelium usually penetrating the epidermis, infection through the stomata being rarely observed. The affinities of the fungus are discussed at length. The species seems to agree with the descriptions of *B. diffusum*, a common saprophyte on rotten wood, branches, and leaves.

Natural methods for the prevention of plant diseases, H. MULLER-THURGAU (*Schweiz. Landw. Centbl., 1900, No. 3, pp. 69–86*).

The use of copper sulphate and sulphur as preventives of plant diseases, J. BEHRENS (*Wchnbl. Landw. Ver. Baden, 1900, No. 9, pp. 110–113*).

The causes of injuries due to spraying with copper fungicides, WEISS (*Prakt. Bl. Pflanzenschutz, 3 (1900), No. 2, pp. 13–15*).

A competitive trial of spraying apparatus (*Ztschr. Pflanzenkrank., 10 (1900), No. 1, pp. 42–53, figs. 12*).—A report is given of the relative efficiency of a number of forms of spraying apparatus in applying various fungicides and insecticides.

ENTOMOLOGY.

Insect pests (*Agr. Bul. Malay Peninsula* [*Gard. and Forest Dept., Straits Settlement*], *1900, No. 9, pp. 252–279*).—This article contains a general classification of the different groups of insects, with notes on the life history and habits of the members of each group, which are injurious in the Malay Peninsula.

An account of the bee-hawk moth (*Cephonodes hylas*) is given by A. L. Butler (pp. 263–266). This insect has caused great damage to coffee in the neighborhood of Petaling. The caterpillars strip the leaves entirely from the coffee trees and feed also upon the green berries after the leaves have been devoured. The transformation from the caterpillar to the pupal stage takes place just beneath the surface of the ground. The duration of the egg stage is from 5 to 7 days, of the larval stage from 4 to 5 days, and of the pupal stage from 10 to 14 days. The bee-hawk moth has few natural enemies which are sufficiently numerous to keep the insect in check. Only a few species of birds were observed feeding upon the caterpillars, and experiments with geckos indicated that these animals do not feed upon the insect.

Among the other economic insects upon which notes are given, the following may be mentioned: *Tinea granella*, *Attacus atlas*, the banana weevil (*Sphenophorus sordidus*), *Hylotoma victorina*, the coffee locust (*Cyrtacanthacris nigrovaria*), and white ants.

The sweet-potato weevil (Cylas formicarius), H. Tryon (*Queensland Agr. Jour., 7 (1900), No. 2, pp. 176–189, pls. 2*).—This insect was first mentioned as injurious to sweet potatoes in Colombo in 1856. The distribution of the species includes Ceylon, part of the West India Islands, the southern portion of the United States, and various parts of Australia. Its first injurious occurrence in Australia was reported in 1886, since which time it has gradually become a formidable enemy to the cultivation of sweet potatoes. In some cases the insect causes the almost complete loss of a crop of sweet potatoes, and is a serious enemy to the crop in all cases, since even when the infestation is of the mildest sort, the presence of the larvæ and adults of the beetle may not always be detected in the sweet potato until it is cut open. The beetle and larva are found in the stems near the surface of the ground and later throughout the substance of the tubers. In the worst cases of infestations none of the tubers attain full development, but are pierced in all directions with the burrows of the weevils. The tunnels made by the larvæ in the tissue of the vines and tubers vary from 2 to 4 mm. in diameter and are not readily recognized until exposure to the air and water has brought about a discoloration of the tissue.

The author gives a description of the insect in all its stages. In Australia the sweet-potato weevil is found in its mature form at all

times of the year. Its food plants include the members of the morning-glory family, but the sweet potato is the plant which is most severely attacked. The mature insect feeds not only upon the stems and tubers, but also upon the succulent veins on the undersurface of the leaves, as well as the leaf petioles. The eggs are usually deposited along the course of the vine, but most frequently as near the base of the stems as possible. About 30 days are required for a complete life cycle, and there are several generations during the 6 months which constitute the life of the sweet-potato plant.

The author discusses the subject of the origin of this insect without coming to positive conclusions. The probability in the case is that the sweet-potato weevil originated in the same country with the sweet potato. It may therefore be considered as plausible that the sweet-potato weevil came from South America.

Severe repressive measures should be adopted against this insect, since its continued presence in a locality renders the raising of sweet potatoes practically impossible. Ordinarily, it is not the first generation of beetles which attacks the tubers, and the first indication of attack is in the stems. It is therefore advisable to cover the tubers more deeply so as to prevent, as far as possible, the beetles from gaining access to them. The author advises also that sweet potatoes be planted in flat culture without throwing the ground into furrows. The sweet potatoes will then be covered more deeply and be more inaccessible to the sweet-potato weevil. It is further advised that when it is found that the tubers are already infested, they should be disposed of as soon as possible in any way which will destroy the beetles contained in them. A bibliography of the literature of this insect is appended to the article.

Some scale insects upon Kansas grasses, E. A. Popenoe and P. J. Parrott (*Kansas Sta. Bul. 98, pp. 131–146, pls. 6*).—The authors made a study of the species of Coccidæ which occur upon the native grasses of Kansas. Some of these grasses are important forage plants, and the injury caused to them by the attacks of the scale lice is considerable.

A table is given for the determination of the different genera of Coccidæ found upon the grasses of Kansas. These genera are Eriococcus, Gymnococcus, Pseudolecanium, Antonina, and Aspidiotus. A list is given of the species of these genera which occur in Kansas, with the name of the host plant in connection with each species. The number of species thus discussed is 8. Descriptions and brief notes are given of all these species, some of which are described as new.

The forest tent caterpillar, C. M. Weed (*New Hampshire Sta. Bul. 75, pp. 107–132, figs. 14*).—This bulletin is a revised form of Bulletin 64 by the same author (E. S. R., 11, p. 269), with additional notes concerning outbreaks of the insect in 1899 and notes on the bird

enemies of this insect. It is stated that the insect was more widely distributed and did more damage during 1899 than in any previous year in which record was kept.

On the authority of Miss Soule, orioles, blackbirds, cedar birds, vireos, robins, catbirds, and sparrows are reported as doing effective work in checking the ravages of the tent caterpillar. The same remedies are recommended which were outlined in Bulletin 64.

The selectmen of the town of Claremont offered a bounty of 5 cents a quart for the cocoons of this insect, and large numbers of cocoons are reported as having been collected.

The crop pest law, W. B. ALWOOD (*Virginia Sta. Bul. 102, pp. 127–152, map 1*).—This bulletin contains a copy of the act of the Virginia State legislature to create and maintain a State board of crop pest commissioners, approved March 5, 1900, and a copy of the rules and regulations adopted by the State board of crop pest commissioners for the prevention of the spread of injurious insects and plant diseases within the State. The purpose of the act is to enable a close supervision to be maintained over the nurseries of the State and shipments of nursery stock into the State from outside sources. Certificates of inspection will be required from all shippers outside of the State. The insect pests and plant diseases included under the Virginia law are San Jose scale, woolly aphis, peach yellows, black knot of plum trees, and fire blight of pear and apple trees.

Portions of Virginia Station Bulletin 79 and the latest report of the State inspector are slightly revised and republished in the present bulletin.

Progress in economic entomology in the United States, L. O. HOWARD (*U. S. Dept. Agr. Yearbook 1899, pp. 135–156, pl. 1*).—The author presents a historical account of the development of economic entomology in this country, in which the States of Massachusetts, New York, Illinois, and Missouri played an important part. In the line of insecticides, attention is called to the progress made in the use of Paris green and other arsenical compounds, kerosene emulsion, and hydrocyanic-acid gas.

A handbook of the gnats and mosquitoes, giving the anatomy and life history of the Culicidæ, G. M. GILES (*London: J. Bale Sons & Danielsson, 1900, pp. 374, pls. 8, figs. 9*).—This is a general treatise on mosquitoes, and treats of the following subjects: Position and terminology of the Culicidæ, anatomy of the adult mosquito, anatomy of the larvæ, characters of the larvæ of the various genera of Culicidæ, anatomy of the pupæ, life history, distribution, and classification of the family.

The second half of the work is devoted to a systematic account of the species of this family group and the following genera: Megarhina, Anopheles, Psorophora, Sabethes, Culex, Ædes, Corethra, and Mochlonyx.

Report on injurious insects and plant diseases in 1899, W. M. SCHØYEN (*Beretning om Skadeinsekter og Plantesygdomme i 1899. Christiania: Grondahl & Sons, 1900, pp. 42, figs. 18*).—This is the annual report of the government entomologist of Norway, and contains notes on a large number of injurious insects and fungus diseases, among which mention may be made of the following: *Aphis granaria*, *Thrips secalina*, ergot, *Charæas graminis*, *Melolontha hippocastani*, potato scab, bacterial disease of tomatoes, cabbage-root maggot, *Psila rosæ*, onion maggot, oyster-shell bark-louse,

codling moth, *Cheimatobia brumata*, *Nematus ribesii*, *Lophyrus rufus*, *Chermes abietis*, and *Rhizotrogus solstitialis*.

Report of the division of entomology, L. Bruner (*Nebraska Sta. Rpt. 1899, pp. 45-49*).—The work of the division has included experiments in controlling the native and migratory locusts in the State by means of fungus diseases. No beneficial results were obtained by this method. Individual farmers were urged to make thorough trials of the hopper dozer. Brief notes are given on the chinch bug, the fall army worm, and the Hessian fly.

Insect record for 1899, C. M. Weed (*New Hampshire Sta. Bul. 72, pp. 59-74, figs. 11*).—The author presents brief popular notes on the life history, habits, and means of combating the tent caterpillars, *Cacœcia cerasivorana*, plum curculio, fall webworm, white grubs, oyster-shell bark-louse, scurfy bark-louse, apple aphis, and the red-legged locust.

The storeroom beetle or bookworm (Sitodrepa panacea), S. F. Aaron (*Sci. Amer., 82 (1900), No. 22, p. 347, figs. 4*).—The author gives notes on depredations committed by this insect upon a number of substances, such as cork, chocolate, books, and herbarium specimens.

The destructive Hessian fly, M. V. Slingerland (*Rural New Yorker, 59 (1900), No. 2639, pp. 573, 574, figs. 3*).—Brief notes on the appearance, life history, injuries, natural enemies, and means of combating the Hessian fly.

The grass thrips (Anaphothrips striata), H. T. Fernald and W. E. Hinds (*Massachusetts Hatch Sta. Bul. 67, pp. 12, pl. 1*).—This bulletin is a simplified form of an article on the same subject in the Report of the Massachusetts Agricultural College for 1899 (E. S. R., 12, p. 266).

The destructive green pea louse, W. G. Johnson (*Rural New Yorker, 59 (1900), No. 2636, pp. 525, 526, figs. 2*).—This insect is reported as injurious to red and crimson clover, as well as to field peas. Experiments were tried in planting peas in rows, which method rendered it possible to use the brush and cultivator method in the destruction of the pea louse. By means of a pine switch the vines were vigorously brushed just ahead of the cultivator, and the lice thus knocked upon the ground were buried to some depth. The operation may be repeated every 3 days during the height of the outbreak of the pea louse. The author states that no spraying method has been devised which will warrant the expense attached to the operation.

Lucern springtail or Smynthurus, W. L. Summers (*Jour. Agr. and Ind., South Australia, 4 (1900), No. 1, pp. 18, 19*).—This insect having proved injurious to lucern, experiments were conducted with various insecticide methods for combating it. Kerosene emulsion, Paris green, and London purple were tried without satisfactory results. Grazing sheep on affected land, harrowing, rolling, and flooding were tried with some success. The remedy which is considered most effective is the application of fresh gas lime. This substance is applied after cutting the lucern, 2 or 3 applications being necessary each year. About 700 to 1,000 lbs. per acre is required for each application.

A new method of combating the gypsy moth, Rörig (*Arb. K. Gesundheitsamte, Biol. Abt., 1 (1900), No. 2, pp. 255-260, figs. 2; abs. in Deut. Landw. Presse, 27 (1900), No. 74, pp. 915, 916, figs. 3*).

The fruit moth (Ophiuza lienardi), C. W. Mally (*Agr. Jour. Cape Good Hope, 17 (1900), No. 1, pp. 41-44*).—According to the reports of correspondents this insect has caused injury to the following fruits: Apples, pears, plums, grapes, peaches, figs, oranges, guavas, bananas, pineapples, loquats, and medlars.

The San Jose and other scale insects, W. Lochhead (*Ontario Dept. Agr., 1900, pp. 48, figs. 21*).—This pamphlet contains a general account of the distribution, injuriousness, life history, habits, and insect enemies of the San Jose scale. The following treatments are recommended: Hydrocyanic-acid gas, whale-oil soap, crude petroleum, and diluted kerosene. Brief descriptive and economic notes are also presented con-

cerning the following scales: The Curtis scale, Forbes scale, Putnam scale, English walnut scale, oyster-shell bark-louse, scurfy bark-louse, and the New York plum scale.

A prospectus of an aphis fauna of Italy, G. DEL GUERCIO (*Nuove Relaz. R. Staz. Ent. Agr., 1. ser., 1900, No. 2, pp. 1–236, pl. 1, figs. 33*).—This article contains detailed descriptive notes on a large number of species, together with tables for the identification of the species. In connection with the discussion of the more important economic species, notes are given on the injurious effects, natural enemies, and means of combating the Aphididæ.

Report of the spread of Phylloxera vastatrix in Austria during 1898–99 (*Bericht uber die Verbreitung der Reblaus in Osterreich in den Jahren 1898–99. Vienna: Ministry of Agriculture, 1900, pp. 170, map 1*).—This pamphlet contains the reports of fruit inspectors and horticultural experts on the condition of phylloxera in different parts of Austria. Numerous tables are given showing the localities infested, the extent of such infestations, and the rapidity of distribution of the phylloxera in different localities. During the year 1898–99, 190 new localities were found to be infested. The distribution of the insect progressed much more rapidly in 1899 than in 1898 on account of the dryness of the former year. The chief remedy against the phylloxera is bisulphid of carbon, of which increasing quantities are purchased from year to year. During the 2 years in question 12,376,000 American grape roots and scions were received for planting.

A new strawberry pest, M. V. SLINGERLAND (*Rural New Yorker, 59 (1900), No. 2636, p. 526, fig. 1*).—The author gives brief notes on the destructive habits of *Harpalus caliginosus* in attacking strawberries. The beetles have also been noticed feeding upon the seeds of ragweed. The author recommends the destruction of ragweeds in and near strawberry gardens and the use of the lantern trap for catching the adult beetles.

The small ermine moths (*Jour. Bd. Agr. [London], 7 (1900), No. 2, pp. 167–169, fig. 1*).—*Hyponomeuta padella* and *H. evonymella* are briefly described. The caterpillars of this species hatch either in the autumn or spring and live gregariously in detached colonies inside of small tents. As remedies against these insects, hand picking, spraying with water under high pressure, kerosene emulsion, and tobacco decoction are recommended.

Contribution toward a monograph of the American Aleurodidæ, A. L. QUAINTANCE (*U. S. Dept. Agr., Division of Entomology Bul. 8, tech. ser., pp. 1–64, pls. 8*).—The author gives a systematic account of this family, including the genera Aleurodes and Aleurodicus. A detailed description is given of all species of this genera known to occur in America, with analytical tables for their determination. In connection with each species brief notes are given on the food plants.

The red spiders of the United States, N. BANKS (*U. S. Dept. Agr., Division of Entomology Bul. 8, tech. ser., pp. 65–77, figs. 16*).—The author gives a brief account of the anatomical structures and habits of the genera Tetranychus and Stigmaeus, together with descriptions of a number of new species.

Forest insects of the Baltic provinces, F. SINTENIS (*Sitzber. Naturf. Gesell. Univ. Dorpat, 12 (1899), No. 2, pp. 173–198*).—The author gives lists of insects injurious to pine, fir, and various deciduous trees in the Baltic provinces, and also lists of insects in this region which attack animals and man in the forest. Brief notes are given on some of the more important of these insects. Among the beneficial insects the author mentions *Formica rufa, Pompilus viaticus, Ammophila sabulosa,* etc.

New parasites of borers, L. ZEHNTNER (*Meded. Proefstat. Suikerriet. West Java, 1900, No. 46, pp. 13, pl. 1*).—A species of Elasmus and a species of Macrocentrus were found parasitic upon *Scirpophaga intacta*. An undetermined brachonid species is found parasitic upon *Diatræa striatalis,* and another brachonid species upon *Sesamia nonagrioides.*

Insects that eat potato beetles, M. V. SLINGERLAND (*Rural New Yorker, 59 (1900), No. 2637, p. 542*).—Brief notes on *Perillus circumcinctus*.

Cost of fumigating an orchard of two hundred and seventy-five trees, W. J. ALLEN (*Agr. Gaz., New South Wales, 11 (1900), No. 9, pp. 754–756*).—Orange trees of medium size were fumigated with hydrocyanic-acid gas, at an average cost per tree of 9 cts.

Petroleum as an insecticide, G. DAVIS (*Rural New Yorker, 59 (1900), No. 2637, p. 542*).—The author relates experiences with kerosene oil sprayed upon peach trees at the time of budding. A serious injury to the tree resulted from the use of kerosene.

Use of nicotine as an insecticide, E. LAURENT and M. CORNU (*Mess. Agr., 5. ser., 1 (1900), No. 6, pp. 232–235*).—A solution of nicotine was prepared with the following constituents: Water, ½; nicotine, 1; methyl alcohol, 10; black soap, 10; carbonate of soda, 2. The insects upon which experiments with this solution were made included the caterpillars of *Bombyx neustria*, *Liparis dispar*, red spiders, bark lice, thrips, etc. The mixture was found to be exceedingly effective against caterpillars, and killed the common species of plant lice within 20 minutes.

Spray calendar (*Vermont Sta. Spec. Bul., Mar. 1900, pp. 4, fig. 1*).—Brief notes on formulæ for the preparation of the more common insecticides and fungicides, with reference to their use in the treatment of common insect and fungus diseases.

FOODS—ANIMAL PRODUCTION.

The ideal ration for an army in the tropics, E. L. MUNSON (*Jour. Mil. Serv. Inst. United States, 26 (1900), No. 105, pp. 309–346*).—On the basis of a review of the literature of the subject and of personal observation, the author concludes that in the tropics less meat and similar nitrogenous food is required than in temperate or cold regions, while the proportion of other constituents of the diet, whose principal function is to yield energy, is also somewhat less. The daily dietary standard proposed for United States troops serving in the tropics is as follows: Protein, 100 gm.; fat, 65 gm., carbohydrates, 650 gm.; and fuel value, 3,491 calories. The diet suggested consists of such articles as fresh beef, bacon, fresh fish, flour, beans, potatoes and some other vegetables, rice, and sugar; in other words, of articles to which the soldier is accustomed and which are supplied under the existing regulations, the chief changes being in the quantities and combinations used. On an average, the 4 dietaries which are proposed as illustrations would furnish 109 gm. of protein and 3,375 calories.

The composition and physiological effects of beef broth, A. GAUTIER (*Dietet. and Hyg. Gaz., 16 (1900), No. 5, p. 273*).—Abstract of an article published in *Le Bulletin Médical*. The composition of beef broth made by boiling 1 kg. of lean beef in 3 kg. of water, with and without the addition of salt and vegetables, is reported. When salt and vegetables were added the dry matter per liter of broth amounted to 27.3 gm. Deducting 7 gm. for the weight of the salt added, this was 1 gm. more than was obtained when the broth was

made with meat and water only. The principal deductions, as given in the abstract, follow:

"Contrary to what might have been thought, the common salt does not aid in dissolving meat in hot water, and . . . the vegetables furnish only 1 additional gram of dry extract per liter. . . .

"On account of the albuminoid substances it contains; on account of its sapid and aromatic substances which act by stimulating the sense of taste and the secretion of the stomach; in virtue of its creatin and xanthin bases, which, in small doses, play, like caffein (which itself belongs to the xanthin group), the rôle of cardiac and muscular tonics; owing to its organic phosphorized derivatives of lecethin; owing, finally, to its assimilable soluble phosphates, well-made beef broth is at once a food properly so-called, a stomachic which excites the gastro-intestinal secretions, and a general tonic. This suffices to explain the vogue which the good beef broth of our housewives has always had—and deservedly so, whatever may have been the prevailing theories."

Cattle foods, G. W. Shaw (*Oregon Sta. Bul. 62, pp. 13, 14*).—Analyses are reported of a number of feeding stuffs, including red clover (*Trifolium pratense*), *T. tridentatum*, *T. eriocephalum*, alsike clover (*T. hybridum*), *T. ciliatum*, *T. incarnatum*, *T.* sp., meadow foxtail (*Alopecurus pratensis*), English rye grass (*Lolium perenne*), cheat (*Bromus secalinus*), vetch (*Vicia sativa*), sweet vernal (*Anthoxanthum odoratum*), spurry (*Spergula maxima*), orchard grass (*Dactylis glomerata*), tall oat grass (*Arrhenatherum avenaceum*), meadow fescue (*Festuca pratensis*), timothy (*Phleum pratense*), oat straw, wild barley (*Hordeum maritimum*), English fescue, native grasses (mixture), sachaline, sugar-beet pulp, salsify, wheat shorts, wheat, oats, and bran mixture (equal parts), oat chop, and wheat chop. The composition of a number of these materials is shown in the following table:

Composition of some Oregon clovers.

	Water.	Protein.	Ether extract.	Nitrogen-free extract.	Crude fiber.	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Trifolium tridentatum	9.51	7.00	1.80	47.21	27.20	7.28
Trifolium eriocephalum	8.58	7.03	2.38	51.26	21.55	9.20
Trifolium ciliatum	10.29	10.06	1.94	45.93	22.20	9.58
Trifolium incarnatum	11.51	10.92	3.16	37.89	29.09	7.43
Trifolium sp	10.05	10.66	3.04	55.02	12.07	9.16

Changes in the chemical composition of feeding stuffs during storage, H. Witt (*K. Landt. Akad. Handl. Tidskr., 39 (1900), No. 3, pp. 139–146*).—The author analyzed samples of feeding stuffs collected in Northern Sweden by Kellgren and Nilson from 1889 to 1894 (E. S. R., 4, pp. 768, 971; 5, p. 808) in order to ascertain what changes, if any, occur in the chemical composition of the air-dry fodders during prolonged storage. The samples were kept in the dark in tightly stoppered bottles. The average results of 2 sets of analyses of 25 samples of grasses and legumes showed that before storage the dry matter

contained 2.18 per cent of ether extract, 2.304 per cent of total nitrogen, and 0.296 per cent of nitrogen not digested by pepsin and trypsin. After storage the amount of ether extract was 2.03 per cent, total nitrogen 2.296 per cent, and nitrogen not digested by pepsin and trypsin 0.388 per cent. When treated with pepsin only, 0.472 per cent was not digested. A second series of analyses of 24 samples showed that on an average the nitrogen content was 2.409 per cent before storage and 2.4 after storage. The author's general deduction was that under the experimental conditions the nitrogen content of the feeding stuffs remained practically constant, while the digestibility of these constituents decreased somewhat. The percentage of ether extract present changed somewhat, but not regularly.—F. W. WOLL.

Analyses of commercial feeding stuffs, J. L. HILLS, C. H. JONES, and B. O. WHITE (*Vermont Sta. Bul. 78, pp. 165–186, fig. 1*).—The commercial feeding stuffs collected in the fall of 1899 and analyzed in compliance with the State law regulating the sale of such materials, including 265 samples of cotton-seed meals, linseed-oil meals, gluten meals, gluten feeds, oat feeds, corn-and-oat feeds, provenders and similar products, wheat feed, poultry feeds, and animal meals.

"No cases of adulteration were found among the cotton seed, linseed, or gluten products, although certain brands do not grade as high as others and are open to improvement. There seems decided tendencies toward greater uniformity of quality with several brands. Many brands of oat feeds, dairy feeds, corn-and-oat feeds, provenders, and the like were found to contain a large quantity of oat hulls, more than they should carry were the goods made from 'pure grains ground together.' Such feeds are of inferior quality, and their purchase is of very doubtful advisability. The more highly concentrated feeds cost more, but for the purpose for which such materials are generally bought—to furnish protein—are much less expensive than low-grade goods."

For purposes of comparison, an average table is given, showing the average composition of the commercial feeding stuffs sold in New England markets, 1898–1900.

Skim-milk calves, H. M. COTTRELL, D. H. OTIS, and J. G. HANEY (*Kansas Sta. Bul. 97, pp. 117–132, figs. 7*).—The possibility of raising calves on skim milk suitably supplemented by other foods is discussed and a test with 13 calves (9 heifers and 4 steers) from scrub cows reported. Four or five days after birth the calves were taken from the cows. Skim milk was then gradually substituted for whole milk. The amount fed was increased, and finally reached 22 to 24 lbs. per head per day. In addition to skim milk, 4 of the calves were fed flaxseed made into a jelly with hot water and 4 were fed Blatchford's calf meal mixed with water to form a gruel. Some dry Kafir corn meal was also fed both lots. The remainder of the calves included in the test received dry Kafir corn meal in addition to skim milk. As the test progressed, corn meal was sometimes substituted for Kafir corn meal with all the calves. The heifer calves were given some

bran, soy-bean meal, oil meal, and ground oats in place of Kafir corn meal to prevent their becoming too fat, as it was the intention to use them for dairy purposes later on. All the calves were fed hay and later were pastured. The skim milk fed 6 of the calves was obtained from a creamery and was sterilized. During this process some water was added to the milk. At first the calves did not relish the sterilized skim milk on account of its peculiar odor, but they soon became accustomed to it and ate it with relish. The remainder of the calves were fed milk from a hand separator. All the milk was warmed before being fed. The authors state that no difference was detected in the condition of the calves fed the 2 sorts of skim milk. The skim milk was discontinued when the calves were 6 months old. The heifer calves then weighed on an average 375 lbs. and the steer calves 383 lbs. Those fed creamery skim milk gained on an average 250 lbs.; those fed hand separator skim milk 251 lbs., about 2,500 lbs. of skim milk being consumed in each case. The authors consider these figures remarkable, since the creamery skim milk contained 10 to 12 per cent of water added in the process of sterilizing. The calves fed the ration containing flaxseed meal gained on an average 1.55 lbs. per day; those fed the ration containing Blatchford's calf meal, 1.9 lbs.; while those fed only dry Kafir corn meal, in addition to skim milk, gained 1.82 lbs. Blatchford's calf meal cost $70 and the flaxseed meal $125 per ton. "Neither paid. And this experiment shows that such expensive feeds added to skim milk are not only unprofitable but useless, having practically no effect on the gain."

The average cost of a pound of gain the authors calculate to be 2.5 cts. The feeding was continued after weaning, the feeding stuffs used being Kafir corn, corn fodder, sorghum, and alfalfa hay. As yearlings the steers averaged 724 and the heifers 564 lbs.

Feeding steers; feed value of cotton seed and its products, J. H. CONNELL and H. C. KYLE (*Texas Sta. Bul. 55, pp. 131–214, pl. 1*).—*Feeding steers* (pp. 131–177).—Two tests with steers were undertaken to study the value of corn meal, oats, and hay when added to a cotton-seed meal and cotton-seed hull ration. The first test was made with 2 lots of 7 and 2 lots of 14 steers each. The test proper began December 24 and covered 140 days. For 100 days lot 1 was fed cotton-seed hulls and cotton-seed meal; lot 2, cotton-seed hulls, cotton-seed meal, and sorghum hay. For the remaining 40 days of the test, corn-and-cob chop was added to the ration of both lots. During the whole test lot 3 was fed cotton-seed hulls, cotton-seed meal, and corn-and-cob chop; and lot 4, cotton-seed hulls, cotton-seed meal, corn-and-cob chop, and oats. The amounts of feed consumed and the gains made by the different lots are given in full. Results are discussed for 100 days and for the whole period. The financial statement is based on cotton-seed hulls at $3, cotton-seed meal at $15, sorghum hay at $6,

oats at \$14.48, and corn-and-cob chop at \$8.32 per ton. The cost of the gains made is also discussed on the basis of different rates for the feeding stuffs. At the close of the test the steers were sold in St. Louis at \$4.35 per hundredweight. The average results of the whole test are shown in the following table:

Results of first feeding test with steers.

	Weight at beginning of test.	Live weight gains.	Cost per pound of gain.	Shipping weight at station.	Shrinkage in shipment.	Dressed carcass.	Waste fat per steer.
	Pounds.	*Pounds.*	*Cents.*	*Pounds.*	*Per cent.*	*Per cent.*	*Pounds.*
Lot 1 (cotton-seed hulls, cotton-seed meal, and, during the last 40 days, corn-and-cob chop)	745.49	243.86	4.000	927.50	6.5	57.19	37.0
Lot 2 (cotton-seed hulls, cotton-seed meal, sorghum hay, and, during the last 40 days, corn-and-cob chop)	777.51	272.08	4.263	996.16	5.9	56.20	37.5
Lot 3 (cotton-seed hulls, cotton-seed meal, and corn-and-cob chop)	749.35	273.46	3.639	965.49	6.7	57.43	33.3
Lot 4 (cotton-seed hulls, cotton-seed meal, corn-and-cob chop, and oats)	737.45	263.49	3.837	943.23	6.6	56.75	33.8

The second test was made with 6 lots of 7 grade Shorthorn steers about 2 years old, and covered 140 days. After they arrived at the station they were fed for a preliminary period of 20 days, at first a ration composed of 12 lbs. of cotton-seed hulls and 3 lbs. of cotton-seed meal; later 18 lbs. of hulls and 4½ lbs. of meal; and finally 20 lbs. of hulls and 4 lbs. of meal. During the test proper lot 1 was fed for 100 days cotton-seed hulls and cotton-seed meal; and lot 2, cotton-seed hulls, cotton-seed meal, and sorghum hay. At the end of this time corn-and-cob chop was added to the ration of both lots. During the whole test lot 3 was fed cotton-seed hulls, cotton-seed meal, and a small amount of corn-and-cob chop. Lot 4 was fed the same basal ration and a large amount of corn-and-cob chop. Lot 5 was fed a small amount of corn-and-cob chop and oats, and lot 6 a large amount, in addition to the same basal ration. The steers were sold in St. Louis and slaughtered. As in the previous test, the results are discussed in full. They are summarized in the following table:

Results of second feeding test with steers.

	Weight at beginning of test.	Live weight gains.	Cost per pound of gain.	Shipping weight at station.	Shrinkage in shipment.	Dressed carcass.	Waste fat per steer.
	Pounds.	*Pounds.*	*Cents.*	*Pounds.*	*Per cent.*	*Per cent.*	*Pounds.*
Lot 1 (cotton-seed hulls, cotton-seed meal, and, during the last 40 days, corn-and-cob chop)	745.49	243.86	4.000	927.50	6.5	57.19	37.0
Lot 2 (cotton-seed hulls, cotton-seed meal, sorghum hay, and, during the last 40 days, corn-and-cob chop)	777.51	272.08	4.263	996.16	5.7	56.20	37.5
Lot 3 (cotton-seed hulls, cotton-seed meal, and a small amount of corn-and-cob chop)	750.71	281.43	3.422	977.21	7.3	57.55	34.3
Lot 4 (cotton-seed hulls, cotton-seed meal, and a large amount of corn-and-cob chop)	748.00	265.50	3.856	953.78	6.6	57.31	32.3
Lot 5 (cotton-seed hulls, cotton-seed meal, a small amount of corn-and-cob chop, and oats)	747.57	271.14	3.875	965.21	6.8	55.63	33.3
Lot 6 (cotton-seed hulls, cotton-seed meal, a large amount of corn-and-cob chop, and oats)	727.33	255.84	3.800	921.25	6.5	57.88	34.3

The author's conclusions follow:

"Sorghum hay is more than equal to cotton-seed hulls, when fed with hulls and cotton-seed meal. The common practice of 'topping out' the hull and meal ration with corn chops is not so profitable as to feed the same amount of corn chops from the beginning. Steers fed 100 days only will make rapid gains on the several rations used.

"When corn chops is combined with hulls and meal, a feed of 2 lbs. of chops made more gain at less cost than when 4 lbs. of chops were used. Equal parts of oats, corn chops, and cotton-seed meal, combined with hulls, make an excellent ration. Corn chops and shelled oats are of equal value for fattening steers when fed with hulls and meal. Steers eating corn chops shrink largely in live weight, when shipped, if the chops is combined with hulls and meal."

Feed value of cotton seed and its products (pp. 178–214).—The composition and feeding value of cotton seed and its products are discussed at considerable length, the experience of the station and a number of individual feeders being cited in detail.

Pig feeding, J. S. NEWMAN and J. S. PICKETT (*South Carolina Sta. Bul. 52, pp. 12, figs. 4*).—Peanuts, sweet potatoes, and field peas were compared with corn with 4 lots of pigs each containing a sow and two barrows. Part of the pigs were 8 and the others 11 months old at the beginning of the test, November 23. In the 84 days of the test the pigs fed peanuts made an average daily gain of 4.32 lbs.; those fed sweet potatoes, 2.59 lbs.; those fed field peas, 3.34 lbs.; and those fed corn, 4.17 lbs. The amounts of the different feeding stuffs consumed per pound of gain were 6.7, 26.2, 6.7, and 9.2 lbs., respectively.

On the supposition that the yield of corn was 15, Spanish peanuts 90, cowpeas 10, and sweet potatoes 200 bu. per acre, and that pork was worth 5 cts. per pound, the authors calculate that (when fed to pigs) corn is worth $6.97; peanuts, $24.37; sweet potatoes, $18.24; cowpeas, $6.12 per acre.

In curing the hams of pigs fed peanuts there was a shrinkage of 22 per cent; in the case of those fed sweet potatoes and cowpeas, 27 per cent; and of those fed corn, 23 per cent. The mean atmospheric temperature was recorded during the test, but no variation in the gains made was attributed to this cause.

Development of the nutrition investigations of the Department of Agriculture, A. C. True and R. D. Milner (*U. S. Dept. Agr. Yearbook 1899, pp. 403–414*).—The development of the nutrition work of the Department is treated of and a brief historical account given of some of the American investigations which antedated this.

Cost and composition of bread in Oregon, G. W. Shaw (*Oregon Sta. Bul. 62, pp. 9–12*).—The cost and composition of 25 samples of bread collected in eastern and western Oregon are reported and the results compared with those of similar investigations in other regions. The composition of whole wheat and wheat flour from eastern and western Oregon is also given. The author notes that samples of bread made from eastern Oregon flour have a higher percentage of protein than those made from flour from the western portion of the State. This variation in protein content was also found in the flour from the different regions.

The gluten constituents of wheat and flour, and their relation to bread-making qualities, H. A. Guess (*Jour. Amer. Chem. Soc., 22 (1900), No. 5, pp. 263–269*).—The gluten and gliadin content of a number of samples of wheat is reported. Analytical methods are described.

A dietary study, G. W. Shaw (*Oregon Sta. Bul. 62, pp. 17–20*).—A dietary study which covered 1 week is briefly reported. It was made with a family consisting of 2 men and 3 women. The usual methods were followed. In calculating the cost, the different food materials were estimated at their usual cost in the Corvallis market. On an average the food actually eaten furnished per man per day 105 gm. of protein, 87 gm. of fat, 543 gm. of carbohydrates, and had a fuel value of 3,809 calories. The cost of the daily diet, including material wasted, was 17½ cts. per man per day.

Canned fish, A. Rössing (*Ztschr. Analyt. Chem., 39 (1900), No. 3, pp. 147–152*).—It was found that the inside of tins in which sterilized codfish and lobsters had been preserved for several years was covered with a white coating, composed of stannic oxid, phosphoric acid, and iron. Imperfect sterilization has no connection with this corrosion, which seems to be due to the action of phosphates and ammonia contained in the codfish and lobster.—C. B. WILLIAMS.

Observations on the food supply of some West Indian Islands, F. Watts (*West Indian Bul., 1 (1900), No. 3, pp. 270–281*).—The principal vegetable foods in the Leeward Islands are described. An analysis of sweet potato flour is quoted, as well as the protein and energy supplied by the Leeward Island Prison diet and the diet of laborers. The latter figures are regarded as approximations only.

The food supply of the United Kingdom, Belgium, France, and Germany, R. F. Crawford (*Miller's Gaz., 23 (1900), Nos. 43, pp. 532, 533; 44, pp. 543, 544; 45, p. 556; 46, pp. 568, 569; 47, pp. 581, 582; 48, p. 594; 49, pp. 604, 605; 52, p. 605*).—A paper read at a meeting of the Royal Statistical Society, November, 1899. Many statistics are quoted.

Flesh foods, with methods for their chemical, microscopical, and bacteriological examination, C. A. Mitchell (*London: Chas. Griffin & Co., Ltd., 1900, pp. 322, pl. 1, figs. 58; noted in Jour. Soc. Chem. Ind., 19 (1900), No. 8, p. 788*).—A laboratory manual.

Preservation of eggs (*Sci. Amer. Sup., 49 (1900), No. 1273, p. 20405*).—A note on a method proposed by K. Reinhard which consists in dipping the eggs into sulphuric acid, thereby forming a coating of calcium sulphate on the shells.

**Starch sugar and starch sirup and their use in the adulteration of "golden

sirup," FRÜHLING and A. RÖSSING (*Internat. Sugar Jour., 18 (1900), No. 2, pp. 317–319*).—A discussion of adulteration and the food value of the adulterant.

Report on the olive oils of Tunis and the utilization of residues from oil making, MILLIAU, BERTAINCHAUD, and MALET (*Bul. Dir. Agr. et Com. [Tunis], 5 (1900), No. 14, pp. 21–62, figs. 7*).—The report contains statistics of the amount of oil produced in Tunis, its value, methods of manufacture, analyses of different samples of oil, and composition and value of oil residues for feeding and for fertilizers.

Cider vinegar: Its solids and ash, R. E. DOOLITTLE and W. H. HESS (*Jour. Amer. Chem. Soc., 22 (1900), No. 6, pp. 218–220*).—The authors report upon adulterated vinegars offered for sale which contain the normal amount of solids and ash. The results of investigation into their character showed that in one case the vinegar was composed of dilute acetic acid, glucose, and soda ash, and in another of acetic acid, boiled cider, and lime.

Baking powders, H. K. MILLER (*Florida Sta. Bul. 52, pp. 131–143*).—Baking powders of different classes are described and an examination of a number of samples of baking powder purchased in Florida reported.

Considering the poisonous properties of respired air, E. FORMANEK (*Arch. Hyg., 38 (1900), No. 1, pp. 1–66, fig. 1*).—An extended review of previous work on this subject is given together with the results of a number of experiments. The principal deductions follow: In addition to carbon dioxid and water, the respired air from the lungs of man and animals contains no poisonous substance, with the exception of occasionally a little ammonia. This, however, is not a metabolic product, but a product of decomposition in the mouth, especially when the teeth are decayed or in the case of certain diseases. The presence of ammonia is sufficient to account for the poisonous properties which other investigators have found in respired air. The bad effects experienced in overcrowded rooms are discussed at some length. They are not regarded as due to any single cause.

The influence of certain alcohols, E. LABORDE (*Jour. Pharm. et Chem., 6. ser., 10 (1899), pp. 484–488; Public Health, 12 (1900), No. 12, p. 885*).—A definite quantity of coagulated egg albumen was digested with acid pepsin or alkaline trypsin in the presence of 50 cc. of 20 and 5 per cent solutions of different alcohols, control experiments being made with water. It was found that isobutyl alcohol, glycerole, and malic acid, when present in small quantity, favored digestion with pepsin, and that methyl alcohol had a slightly accelerating influence. But digestion was markedly retarded by ethyl and propyl alcohol, lactic and tartaric acid, manitol, and glucose. When trypsin was the ferment used methyl and isobutyl alcohols, glycerole, and glucose increased digestion, and ethyl and propyl alcohol, lactic, malic and tartaric acids, and manitol diminished it.

The quantitative effect of pepsin, J. SCHÜTZ (*Ztschr. Physiol. Chem., 30 (1900), No. 1–2, pp. 1–14*).—Experiments are described which have to do with the quantitative results obtained in artificial digestion by means of pepsin.

Concerning certain quantitative relations in pepsin digestion, HUPPERT (*Arch. Physiol. [Pflüger], 80 (1900), No. 8–10, pp. 470–526*).—Investigations carried on by the author and E. Schütz are reported.

On the occurrence of proteolytic and amylolytic ferments in the contents of the human colon, J. C. HEMMETER (*Arch. Physiol. [Pflüger], 81 (1900), No. 4–5, pp. 151–166*).—An experimental study of the ferments which are found in feces. Normal feces yielded an extract which digested dried pulverized blood fibrin and egg albumin in alkaline or neutral solution, while but little if any reaction took place in an acid solution. The amylolytic ferment found in the feces was active in an alkaline solution but not in an acid solution.

Concerning the organic phosphorus in feces from woman's milk and cows' milk, P. MÜLLER (*Ztschr. Biol., 39 (1900), No. 3, pp. 451–481*).—Experiments are reported with children fed mother's milk and cows' milk, with a dyspeptic child fed cows' milk, with adult men consuming milk, with adult men consuming

beans, with nursing calves, and with a fasting dog. Special attention was paid to studying the ratio of nitrogen to phosphorus in feces. The author believes his experiments show that no more material rich in phosphorus is retained in the intestinal tract of normal nursing children when cows' milk is consumed than when woman's milk is consumed. Further, that the casein phosphorus is as well assimilated by adults on a moderate milk diet as by infants.

Cattle foods—miscellaneous analyses, H. H. NICHOLSON (*Nebraska Sta. Rpt. 1899, pp. 38, 39*).—Analyses of oat hay, corn fodder, old-process oil meal, potatoes, hog millet, dried peas, squaw corn, corn, wheat, rye, and corn germ.

Cotton seed, W. C. MACKENZIE (*Jour. Khediv. Agr. Soc., 2 (1900), No. 1, pp. 7–11*).—A number of analyses of Egyptian cotton seed are reported and cotton seed in general discussed.

Linseed cake v. cotton cake, PATTERSON (*Farmers' Gaz., 59 (1900), p. 370*).—A brief account is given of a comparison made with steers of cotton-seed cake and linseed cake with and without maize meal. Swedish turnips, hay and straw were fed in addition to the other feeding stuffs.

Dangers attending the use of grain as feed for stock, M. PELLERIN (*Jour. Agr. Prat., 1900, I, No. 23, pp. 816–818*).—A general discussion.

The assimilation of iron, E. ABDERHALDEN (*Ztschr. Biol., 39 (1900), No. 2, pp. 193–270*).—Experiments with rats, rabbits, guinea pigs, cats, and dogs are described.

Concerning the nutritive value of the heteroalbumoses of fibrin and the proteoalbumoses of casein, L. BLUM (*Ztschr. Physiol. Chem., 30 (1900), No. 1–2, pp. 15–44*).—The author describes a number of experiments with dogs. Final deductions are not drawn. In the author's opinion further investigations will show that the products of digestion of the proteid molecule vary considerably, as his experiments indicate that certain albumoses (the proteoalbumoses of casein) are well suited to replace albumin, while others (the heteroalbumoses of fibrin) are less suited.

The development of the energy of motion of forward progression in a horse, P. LE HELLO (*Rev. Sci. Paris, 4. ser., 13 (1900), No. 14, pp. 417–421, figs. 8*).

Work of the breeders in improving live stock, J. CLAY, JR. (*U. S. Dept. Agr. Yearbook 1899, pp. 627–642*).—A general article giving historical and statistical data.

The principles of sheep breeding, J. S. H. SCHMIDT (*Queensland Agr. Jour., 4 (1899), No. 6, pp. 432–440; 5 (1899), Nos. 1, pp. 15–26; 3, pp. 270–275; 4, pp. 356–361; 5, pp. 443–452; 6 (1900), Nos. 1, pp. 5–8; 2, pp. 86–88; 3, pp. 172–176*).—A general discussion of sheep and sheep management.

Economic value of goats (*Jour. Jamaica Agr. Soc., 4 (1900), No. 7, pp. 445–450*).—The advantages of goat keeping are pointed out and the subject discussed in a general way.

Pigs and their management (*Queensland Agr. Jour., 5 (1899), No. 6, pp. 537–546; 6 (1900), Nos. 1, pp. 12–17; 2, pp. 93–100; 3, pp. 190–196; 4, pp. 267–276; 5, pp. 356–360*).—An illustrated general article, summarizing some of the principal experiments on the subject.

Pig feeding experiments with Ohlendorff's meat meal, LILIENTHAL (*Deut. Landw. Presse, 27 (1900), Nos. 40, pp. 510, 511; 42, pp. 519, 520*).—From experiments reported in detail the conclusion is drawn that this meat meal can be profitably fed with proper precautions to young and growing pigs.

Queensland Agricultural College. Experimental pig feeding, J. MAHON (*Queensland Agr. Jour., 6 (1900), No. 5, pp. 365–368, pl. 1*).—A comparison of boiled mangels and swill with boiled mangels and barley as a food for pigs showed that much better results were obtained with the former, the gain being 1.65 lbs. per head per day as compared with 0.06 lb. From a financial standpoint the addition of the barley was judged to be profitable.

Note on Bunsen's ice calorimeter, J. W. MELLOR (*Jour. Phys. Chem., 4 (1900), No. 2, pp. 135, 136, fig. 1*).

DAIRY FARMING—DAIRYING.

Investigation in milk production, T. L. HAECKER (*Minnesota Sta. Bul. 67, pp. 333–516, 550–556, figs. 30, dgms. 3*). This is a detailed report of dairy work covering a period of 3 years, 1894–1896.

System of keeping dairy records (pp. 334–340). Illustrations from the milk and feeding records of the dairy herd are given and briefly discussed.

Herd record for 1894 (pp. 340–355).—The herd included 26 cows, 10 of which remained during the year. A full account is given of the management and record of the herd. Tables show the nutrients in the rations fed, the milk and fat produced, amount and cost of food consumed, etc. The 10 cows produced during the year on an average 4,909.7 lbs. of milk, containing 232.8 lbs. of fat, at a cost for food of $29.72. The corresponding averages for 1893 were 6,407.7 lbs. of milk, 306.9 lbs. of fat, and $37.82, cost of food.

Comparing wheat with barley and corn (pp. 356–365).—A ration containing 7 lbs. of wheat was compared with a ration containing 4 lbs. of barley and 3 lbs. of corn. In addition each ration contained the same quantities of bran, oil meal, timothy hay, and roots. The test was made with 12 cows, divided into 2 equal lots, and covered 4 periods of 2 weeks each. The rations were changed during alternate periods. The production of milk and butter fat was practically the same on the two rations. Slightly more digestible protein was required for the production of butter fat when the wheat ration was fed. The results are considered as showing no practical difference in the feeding value of ground wheat and ground barley and corn.

Comparing prairie hay with timothy (pp. 366–379).—Prairie hay and timothy hay were compared in rations containing grain and silage in addition. The test included 12 cows and lasted 8 weeks. The cows produced more milk but less butter fat on timothy hay than on prairie hay. When prairie hay was fed more dry matter was required for the production of milk and less dry matter for the production of butter fat than when timothy hay was fed. The general conclusion is drawn that the two kinds of hay have equal feeding value. The cost of production of 1 lb. of butter fat was 13.3 cts. on timothy hay and 11.5 cts. on prairie hay.

Herd record for 1895 (pp. 380–415).—A description is given of each of the 13 cows remaining in the herd during the year, together with a detailed account of the feeding and care of the herd. Results for the year are tabulated and discussed. The average production per cow was 7,418.6 lbs. of milk, containing 302.3 lbs. of fat. The average cost of food was $28.47.

Eight cows of the herd were divided into 2 groups according to type. Group 1 contained cows spare and angular in conformation and having

deep bodies through the middle, and group 2 cows having a tendency to lay on flesh. The average production of the 4 cows in group 1 was 8,283.1 lbs. of milk and 445.97 lbs. of butter, and of the 4 cows in group 2, 6,817.6 lbs. of milk and 303.01 lbs. of butter. The cost of food was respectively $30.82 and $28.21.

The herd was increased during the winter of 1895–96, and a record of each cow from the beginning of lactation in the fall until the herd was turned out to pasture in the spring was compiled separately. Sixteen of the cows were divided into the 2 groups noted above. The cows in group 1 produced on the average 90.14 lbs. more butter than the cows in group 2 and at an average cost of 1.95 cts. less per pound.

Record of cows during period of lactation (pp. 416–440).—An individual record is given of 15 cows during a period of lactation. The average production of milk per cow was 7,227 lbs., and of butter 335 lbs. Variations in the amount and cost of butter production of individual cows are noted. A summary of the records of 12 cows classified according to the types mentioned showed an average production for group 1 of 6,720 lbs. of milk and 446 lbs. of butter, and for group 2 of 5,077 lbs. of milk and 229 lbs. of butter, the net return in the 2 cases being respectively $38.11 and $10.37.

Herd record for 1896 (pp. 441–457).—The herd contained 13 cows. The results for the year are summarized in tables. The average yield of milk was 7,454 lbs., containing 299.39 lbs. of fat and costing $22.12 for feed. The herd was again divided according to type. The cows in group 1 gave an average yield of 8,580.3 lbs. of milk and 460.02 lbs. of butter, and the cows in group 2 6,248.9 lbs. of milk and 270.86 lbs. of butter. The cost of food in the two cases was respectively $23.35 and $22.11. In discussing results the author says:

"Five years of careful investigation in regard to the cost of production of butter between cows spare and angular in form, and cows carrying considerable superfluous tissue and having an inherited or acquired disposition to convert feed into flesh, show that in every instance the cow that carried the least flesh charged the least for butter, and just in so much as one cow was a little smoother and plumper than the other would her butter product cost more than that of the other."

The records also indicate that cows of the spare and angular type remain in good service for a very much longer period than cows having a tendency to lay on flesh.

Variation in productive capacity of dairy cows and cost of production (pp. 458–481).—The author reviews work previously reported (E. S. R., 6, p. 925) and discusses at greater length the records of the herd noted above, especially as regards cost of milk and butter production, variation in the production of cows of different types, variation in the amount of dry matter required for the production of butter fat, amount of dry matter required for food of maintenance, and testing dairy cows.

"The records show that under the system of feeding it required from 8 to 9.6 lbs. of dry matter over and above that calculated for food of maintenance to produce a pound of butter by cows under normal conditions, but this might be materially reduced if the ration contained more grain and less roughage and the nutrients were adjusted to the exact requirements of the cow."

Comparing the cost of butter and meat production (pp. 482–495). An account is given of an experiment conducted with 4 steers and 4 cows during the winter of 1896–97 to compare the cost of butter and meat production. The test covered 2 periods of 5 weeks each. The results are discussed at some length and summarized as follows:

"(1) With 100 lbs. of grain and an equal amount of hay and roots 4 steers made a gain of 24.19 lbs., and 4 cows with the same amount and kind of feed produced 12.04 lbs. of butter.

"(2) The 4 steers consumed feed valued at \$8.51, gained 424 lbs., being an average daily gain of 2.52 lbs., costing 2 cts. per pound and returning a pound gain for 8.2 lbs. of dry matter consumed.

"(3) The 4 cows consumed feed valued at \$11.84, yielded 255.42 lbs. butter fat, being a butter equivalent of 297.99 lbs. at a cost for feed of 3.97 cts. per pound, producing a pound of butter to 16.28 lbs. of dry matter consumed.

"(4) Type has not so much significance with a steer as it has with a dairy cow for the reason that a steer not of good type may be a large feeder and a good digester and convert all the food taken over his needs for maintenance into gain, while a cow not of the dairy type has the alternative of converting food either into milk or gain, and she may choose the latter at a time when the owner wants only the former.

"(5) Any sudden change in feeding or handling may cause a loss in weight or shrinkage in yield of milk and butter fat."

Variation in flow and percentage of fat in milk (pp. 496–516). -Tables show the daily and weekly variations in the yield and fat content of the milk of one cow during the first 4 weeks of lactation. Results for 4 years are summarized as regards the effect on the yield and fat content of milk due to changing from dry feed to pasture. The following table gives the data for the dairy herd for 4 years during the 8 weeks preceding and the 8 weeks following a change from stable to pasture, the 8 weeks in each case being divided into 4 equal periods:

Average record of dairy herd for 4 years before and after turning out to pasture.

	Total yield of milk.	Average fat content of milk.	Total yield of fat.
On dry feed:	*Pounds.*	*Per cent.*	*Pounds.*
Period 1	14,463.4	4.11	594.80
Period 2	14,047.7	4.23	594.60
Period 3	13,692.9	4.29	587.63
Period 4	13,669.0	4.15	566.77
On pasture:			
Period 1	14,635.2	4.27	624.64
Period 2	15,219.4	4.06	618.62
Period 3	14,710.3	3.96	583.20
Period 4	13,524.5	4.11	555.26

Dairy value of pea-vine silage compared with that of June pasture, A. T. NEALE (*Delaware Sta. Bul. 46, pp. 9–12*).—During the

winter 9 head of young cattle were fed a ration averaging 25 lbs. of pea-vine silage and 6 lbs. of hay, at an average daily cost of 3.5 cts. per head. The animals improved rapidly, showing that the ration was suitable for growing stock.

Three cows were fed during the winter a ration containing 50 lbs. of pea-vine silage and a grain mixture of corn meal and cotton-seed meal. The nutritive ratio was 1:4.75. There were no striking variations in the results. During one week in May green rye was substituted for the silage. The cows were then turned out to pasture, the grain ration remaining the same. "The change from silage to pasture indicated a possible gain of one-half pound of butter per cow per week." Owing, however, to the higher price of butter earlier in the season there was a net gain of 32 cts. per week from the 3 cows in favor of silage. The relative cost of silage and pasturage is considered, showing an excess against silage of $2.91 per acre.

On the influence of heredity on the quality of cows' milk, G. Cederholm (*Landtmannen, 11 (1900), No. 10, pp. 157-161*).—The author has accumulated evidence bearing on the question of the influence of heredity on the quality of a cow's milk, during systematic tests of the large dairy station herd of cows at Aalberga, Sweden, for a period of 5 years. Appreciating that the system of feeding, time of calving and of lactation, age of cows, and other factors may render uncertain comparisons of the average quality of the milk of different generations, the variations in fat content possibly due to these factors were first ascertained in studying the results of these tests. The system of feeding practiced and the method of handling the cows were as uniform as possible throughout the year, but marked differences were nevertheless found in the milk produced by the whole herd during the different months of the year. The following table shows the average quality of the herd milk during each month, and also the average percentage of fat in the milk of cows that calved in the different months:

Average fat content of milk of cows calving in different months.

Month.	Herd milk.	Milk of cows calving in different months.
	Per cent.	*Per cent.*
January	3.62	3.48
February	3.54	3.48
March	3.53	3.45
April	3.45	3.40
May	3.37	3.42
June	3.27	3.41
July	3.40	3.50
August	3.61	3.40
September	3.57	3.53
October	3.56	3.47
November	3.70	3.55
December	3.66	3.48
Average for year	3.43	....

Since the number of cows calving was about the same during the different months of the year, the changes found in the fat content of the herd milk can not be due to inequality in numbers, and it is seen that but slight variations occur in the average quality of the milk of cows that drop their calves in different months of the year.

The milk of cows that milked longer than 11 months was found to contain, on the average, between 3.6 and 3.8 per cent of fat.

No decided effect of age on the quality of milk was found, there being an extreme difference of less than 0.1 per cent in the average fat content of milk from cows from 3 to 13 years old; data for about 50 cows were included in each of the groups for the different years.

The author concludes that the data obtained furnish evidence as to the influence of heredity on the quality of the milk. Tables are given showing the average fat content of the milk of dams and their daughters for each of 5 sires used, a summary of which follows:

Increase or decrease in the average fat content of cows' milk as compared with that of their dams' milk.

Fat content of dams' milk.	Ossian 530.			Bill 717.			McDonald 628.			Dash 2d 660.			Dash 517.		
	Number.	Increase.	Decrease.	Number.	Increase.	Decrease.	Number.	Increase.	Decrease.	Number.	Increase.	Decrease.	Number.	Increase.	Decrease.
2.81–3.0													1	1.15	
3.01–3.1	4	0.50											1	.94	
3.11–3.2	2	.18		5	0.37		2	0.40		2		0.30	1	.75	
3.21–3.3	2	.32		5	.32		2	.19							
3.31–3.4	1	.16		1	.67										
3.41–3.5	1		0:10	7	.29		1	.05					1	.34	
3.51–3.6	1	.01		4	.06		4		0.27	1		.31			
3.61–3.7	1	.25		2	.01		1		.06	1		.37			
3.71–3.8				1		0.20				1		.49			
3.81–3.9							1	.27							
3.91–4.0				1		.67									
Average	*a*16	.42		*a*26	.21		*a*12	.09		*a*5		.38	*a*4	.80	

a Number of daughters included.

Three of the bulls caused a marked improvement in the quality of the milk produced by their offspring, while in case of one bull (McDonald 628) there was an improvement in 7 cases and a deterioration in 5 cases (on the average an increase of 0.09 per cent), and Dash 2d 660 in all cases had daughters that gave poorer milk than their dams. This bull was out of a cow, Gullros 2d 551, that produced milk of a poor quality, the average percentage of fat in her milk being 3.06. In general the greatest improvement was observed in case of cows producing the poorest grades of milk. The data so far secured on this point are not considered sufficient to permit of definite conclusions as to the relative influence of the ancestors of a cow on the quality of milk produced by her, but they show, at any rate, that the bull exerts a decided influence for better or worse on the milk product of his progeny.—F. W. WOLL.

Galactase, E. von Freudenreich (*Landw. Jahrb. Schweiz, 14 (1900), No. 2, pp. 49–55; Ann. Agr. Suisse, 1 (1900), No. 3, pp. 77–84*).—Experiments were conducted in duplication of some of the work reported by Babcock and Russell (E. S. R., 10, p. 785). Skim milk to which 10 to 20 per cent of ether had been added was kept at room temperatures and also at 35° C. The soluble nitrogen in the milk at different periods from 1 to 8 months was determined in one series of experiments by the method employed by Babcock and Russell (heating with acetic acid) and in another series by the use of the Chamberland filter. In each series the nitrogen was determined in the filtrate by the Kjeldahl method. The results of the experiments confirm the work referred to.

Bacterial growth of *Tyrothrix tenuis* in skim milk and also in bouillon cultures was prevented by the addition of 10 to 12 per cent of ether. The addition of 20 per cent of ether to the milk as compared with 10 per cent increased the swelling of the casein which was precipitated in a flaky gelatinous form, but did not increase the soluble nitrogen. Milk heated to destroy the galactase and treated with ether showed no increase in soluble nitrogen. The presence of 0.3 to 0.5 per cent of lactic acid decreased markedly the action of the enzym. Formalin lessened the action of galactase and to a less extent that of pepsin and pancreatin, which had been added to sterilized skim milk. Dilution of the milk did not lessen the action of galactase. Heating to 85° destroyed it. Sterilized skim milk to which 20 per cent of ether had been added was inoculated with a few drops of an emulsion of spores of *Tyrothrix tenuis* and incubated at 35° C. Another sample was similarly treated, except that the bacterial culture was previously heated to 100° C. to destroy the enzyms present. There was an increase in the soluble nitrogen in the first case and none in the second, which was considered as showing that bacteria and their spores may contain proteolytic enzyms. Galactase would not pass through a porcelain filter.

The author does not believe that galactase plays the principal rôle in the ripening of cheese, especially Emmenthaler, but thinks that in rendering the casein soluble it possibly prepares for and facilitates the work of the bacteria which cause the ripening and produce the flavor.

Dairy development in the United States, H. E. Alvord (*U. S. Dept. Agr. Yearbook 1899, pp. 381–402, pls. 8, figs. 12*).—This is an account of the development and present status of dairying in the United States. The progress made in the different periods of the nineteenth century is described. The establishment, features, and management of cheese and butter factories are considered. Notes are given on the introduction of dairy cattle and efforts at herd improvement. The centrifugal cream separator and the Babcock milk tester are described. The article closes with statistical information on the number of cows and quantity and value of dairy products.

Feeding dairy cows, T. L. Haecker (*Minnesota Sta. Bul. 67, pp. 517–549*).—This

is a reprint in a somewhat revised form of an article previously noted (E. S. R., 10, p. 1095).

Feeding for milk, J. MAHON (*Queensland Agr. Jour., 7 (1900) No. 1, pp. 24, 25*).

On the influence of the lactation period on the productive capacity of cows, F. W. WOLL (*Breeders' Gaz., 38 (1900), No. 9, pp. 239-240; Hoard's Dairyman, 31 (1900), No. 31, pp. 626, 627*).—Variations in the yield and quality of milk during lactation are discussed and illustrations given from the records of the Wisconsin Station herd.

The quality of Scandinavian milk, R. H. WALLACE (*British Food Jour., 2 (1900), No. 22, pp. 276, 277*).—A brief discussion concerning the average composition of milk in Sweden, Norway, and Denmark.

Variation in lactic acid bacteria in relation to fermentative power, N. P. SCHIERBECK (*Overs. K. Danske Vidensk. Selsk. Forhandl., 1900, No. 2, pp. 113-137*).

Determination of the extent of milk adulteration, H. HÖFT (*Molk. Ztg., 14 (1900), No. 14, pp. 221, 222*).—Directions are given for calculating the percentages of skim milk and water added to milk as adulterants.

Acidity of milk and the action of rennet, T. AUFSBERG (*Molk. Ztg., 14 (1900), No. 18, pp. 293, 294*).—Notes are given on the determination of the acidity of milk, and 4 experiments are reported in which rennet tests were made of milk of different degrees of acidity. An increase in the acid content of milk of a low degree of acidity lessened in a much greater proportion the time required for coagulation than the same increase in the acid content of milk of a high degree of acidity.

Present views on the ripening of Cheddar cheese, J. MCCREATH (*Dairy, 12 (1900), No. 142, pp. 281, 282*).

Annual report of the experiment station for cheese making at Lodi, 1899 (*Ann. R. Staz. Sper. Caseif. Lodi, 1900, pp. 110*).—In addition to a general review of the work of the station during the year, this contains reports on several lines of investigation, including margarin in cheese, false "erborinatura" in Stracchino Gorgonzola cheese, method for determining the fat content of cream and calculating its equivalent in butter, the manufacture of casein for industrial purposes, cooperative dairying, white clover soils of Lombardy, and the deficiency of lime in meadow soils of lower Lombardy.

VETERINARY SCIENCE AND PRACTICE.

Remarks on the epidemiology and prophylaxis of malaria in the light of recent researches, A. CELLI (*British Med. Jour., 1900, No. 2041, pp. 301-306*).—Man is the temporary host and the mosquito is the definite host of the malarial parasite. The species of mosquitoes which are capable of carrying the specific malarial parasites and of affecting man belong to the genus Anopheles. In Italy *Anopheles claviger*, *A. bifurcatus*, *A. superpictus*, and *A. pseudopictus* are injurious. It is improbable that species of Culex or other blood-sucking insects carry the malarial organism. Anopheles lay their eggs in slowly running or stagnant waters, where the larvæ of the genus Culex are seldom found. The larvæ offer slight resistance to desiccation. Freezing, especially if the ice be continuous, is unfavorable to the immature forms, as is also continued putrefaction in the water. In Italy mosquitoes begin to bite man about the second half of June and continue to do so until hibernation. The species of Anopheles do not

make the humming sound which is characteristic of Culex, and are, therefore, often present in rooms without being suspected.

The author discusses at some length the relationship of agriculture to malaria, and states his belief that the plowing of new soil does not contribute to the spread of malaria.

The fatal effect of green sorghum, R. S. HILTNER (*Nebraska Sta. Bul. 63, pp. 71–84*).—The use of sorghum as a forage plant in the State is becoming more extensive, and with its increase in importance for this purpose the number of deaths caused by feeding it increases. During the past year 144 fatal cases in cattle were reported.

The work reported in the present bulletin was undertaken for the purpose of determining, if possible, the nature and cause of these cases of poisoning. Frequent reports are made of bloat caused by the use of sorghum for forage. It has been supposed in some cases that the cause of death from using sorghum was to be found in the presence of parasitic fungi on the leaves of the plants. In a number of instances it has been believed by stockmen that plants were maliciously poisoned with strychnine, Paris green, or arsenic. Analyses made by the station of plants thus suspected indicated no trace of any such poison. Another suggestion made to explain poisoning by sorghum is that the plant takes up an unusual quantity of potassium nitrate during certain seasons or in certain localities. A number of samples analyzed indicated only a trace of nitrates. The most commonly believed theory for the explanation of poisoning by sorghum is that the plant under certain conditions develops a poisonous principle. The chemical department of the station undertook an investigation of this matter. In reports from stockmen it was noted that the symptoms were nearly uniform in all parts of the State and that the poisoning was not confined to animals of any particular age.

Samples of sorghum which had caused the death of cattle were analyzed in a fresh green condition and also after drying. Aqueous extracts were made and tested for chemical poisons, but none were found. No chemical compound was discovered which could be considered poisonous. It is of importance to note in this connection that the nitrogen content of the samples which were analyzed was not above the average. The opinion is somewhat widespread that the second growth of sorghum is more dangerous than the first growth. This may have been the experience of stockmen in some localities, but when all cases which have been reported from different parts of the State are considered it is found that the first growth is not always harmless and the second growth is not always poisonous. The majority of cases of poisoning reported were due to eating the second growth of sorghum. It should be stated, however, that the first growth is not fed in a green state to the same extent as the second growth, and this fact may account for the more extensive poisoning from second-growth plants.

The author concludes that the toxic effect of this plant which is manifested at certain times is not due to a poisonous principle inherent in the plant and is not peculiar to the second growth alone. The problem is, therefore, still unsolved.

Report on cooperative experiments in the treatment of hog cholera, A. T. PETERS, C. M. DAY, and C. H. WALKER (*Nebraska Sta. Rpt. 1899, pp. 64–90*).—The authors decided to test the value of inoculations with attenuated virus in the treatment of hog cholera. Twenty pigs weighing from 40 to 60 lbs. each were inoculated with 0.2 cc. of unattenuated virus, 2 pigs being inoculated each day. The first inoculation was made when the virus was 3 days old. Of this lot the first pig became sick 16 days after the inoculation, or 4 days after the period of incubation, while the last pig to show signs of hog cholera was taken sick 22 days after the period of incubation. It is therefore apparent that the infection was not the result of the artificial inoculation, but of hog-cholera germs present in the pens. Six pigs were inoculated with virus made according to the method of Dr. Billings. Thirty-one days after the first inoculation it was thought safe to inoculate a second time with 0.3 cc. of virus. The second inoculation was made July 25 and on August 1 all the pigs refused food. All of these pigs with but one exception ultimately died, and the exposure experiments with this one demonstrated that it had become immune to hog cholera.

The authors conducted experiments with virus prepared according to the Pasteur method of making blackleg virus. In general the spleen was selected as the organ from which the virus was prepared. May 3, 3 pigs were inoculated with this virus. One pig showed mild symptoms of hog cholera May 23 which continued to the 29th, when recovery apparently took place. May 31 these pigs were fed upon the viscera of a pig that had died of hog cholera. The inoculated pigs did not contract the hog cholera, while the check pigs all died of the disease.

Experiments were conducted in inoculating pigs with a mixture of antitoxic serum and virulent culture. The injection had no perceptible effect upon the pigs thus treated, and after 42 days they were exposed to hog cholera in a badly infected pen. All the pigs took sick within the period of incubation, thus showing that this method does not increase their resistance to the disease. Experiments with the Lorenz method gave entirely negative results. A modification of the Lorenz method was tried in which the pigs were first inoculated with virulent culture and later with a dose of serum. The pigs thus treated did not contract the disease until 28 days after receiving the inoculation. These pigs resisted infection 21 days longer than the pigs treated by the ordinary Lorenz method.

In experiments conducted for the purpose of determining the value of gradually increasing doses of antitoxic serum in the treatment of

hog cholera. 10 pigs were inoculated in this manner and after exposure to the disease did not become sick until after the period of incubation, and 1 animal showed complete immunity.

During the experiments conducted at the station it was noted that all efforts to secure perfect disinfection of pens were unsuccessful. A direct experiment was tried for the purpose of testing the disinfection of the pens. A pen which had been used for inoculating purposes was selected for this purpose. All refuse was swept up and burned and the floors were thoroughly soaked and washed in a strong solution of zenoleum, the walls and partitions being treated in like manner. The floor was removed and all refuse found below the floor was collected and burned. The floor was then covered with a thick coating of air-slaked lime. Two healthy pigs were placed in this pen July 30. Both of these pigs contracted the disease and died. Experiments conducted by the station with powdered virus indicated that this method is very efficacious if carried out under the best conditions. Such conditions, however, can not be found in old pens in which diseased hogs have been confined. The best conditions for conducting such experiments are to be found on the farm, in new pens, or on uninfected ground.

A note on serum diagnosis of glanders, BOURGES and MÉRY (*Arch. Méd. Exper. et Anat. Path., Paris, 1. ser., 12 (1900), No. 2, pp. 182–188*). The experiments of the authors on this subject included a study of the reactions of glanderous serum in horses which were not affected with glanders, in glanderous horses which exhibited clinical symptoms of the disease, and in horses which reacted to the mallein test but showed no clinical symptoms.

The general conclusions of these experiments may be stated as follows: If the blood of a horse agglutinates the glanders bacillus when diluted to the extent of 1 to 300 parts or more, the presumption is that the horse is glanderous. Agglutination in cases of less dilution does not necessarily imply the presence of glanders in the horse.

Some examples of the development of knowledge concerning animal diseases, D. E. SALMON (*U. S. Dept. Agr. Yearbook 1899, pp. 93–134*).—The author presents a brief historical account of the study of glanders, cowpox, horse pox, contagious pleuro-pneumonia of cattle, anthrax, blackleg, and Texas fever.

Administrative work of the Federal Government in relation to the animal industry, G. F. THOMPSON (*U. S. Dept. Agr. Yearbook 1899, pp. 441–464*).—An historical account is given of the quarantine and administrative work of this Department in combating contagious pleuro-pneumonia, Texas fever, sheep scab, hog cholera, blackleg, bovine tuberculosis, in the inspection of animals intended for slaughter, and in the inspection of meat.

Diseases of animals (*Rpt. Provincial Bd. Health Ontario, 1899, pp. 33, 34*).—Brief reports are given on cases of canine rabies, anthrax, and blackleg.

Report of the animal pathologist, A. T. PETERS (*Nebraska Sta. Rpt. 1899, pp. 25–28*).—The division of animal pathology has devoted attention to hog cholera, blackleg, calf cholera, ergotism, keratitis, cattle itch, foot disease, lumpy jaw, tuberculosis, and glanders.

Prophylaxis of infectious diseases of animals, NOCARD (*L'Ing. Agr. Gembloux, 10 (1900), No. 11, pp. 657–676*).—The author discusses in a general way methods of producing immunity by means of the inoculation of pure or attenuated virus and by serum therapy.

Phagocytosis and the blood-destroying leucocytes, C. ROUGET (*Compt. Rend. Soc. Biol. Paris, 52 (1900), No. 13, pp. 307–309*).—A controversial article on the problem of the nutrition of leucocytes. The author believes that the phagocytes derive nourishment preferably from dead material.

The structure of bacteria, FEINBERG (*Centbl. Bakt. u. Par., 1. Abt., 27 (1900), No. 12–13, pp. 417–426, pls. 5*).—The author made a study of a number of bacteria, among which may be mentioned the anthrax bacillus and the tubercle bacillus. It was found that in all cases a double stain could be used successfully on these organisms. As these stains were such as are usually employed in differentiating nuclear and protoplasmic substances in ordinary cells, it is concluded that bacteria possess a similar differentiation of the cell body.

Adaptation of pathogenic bacteria to different species of animals, T. SMITH (*Sep. Philadelphia Med. Jour., 1900, May 5, pp. 12*).—In this paper the author classifies infectious diseases into 4 groups: Diseases common to man and animals and transmissible from one to the other; diseases common to man and animals but not transmissible; diseases transmitted from animals to man but usually not from man to man; and symbiotic relations, requiring 2 hosts for the life cycle.

The elimination of bacteria by means of the kidneys and liver, MÉTIN (*Ann. Inst. Pasteur, 14 (1900), No. 6, pp. 415–419*).—The organisms which were used in these experiments included *Bacillus subtilis*, *Staphylococcus aureus*, *B. anthracis*, and *B. prodigiosus*. Great difficulty was experienced in devising a method for drawing the urine directly from the bladder without allowing any blood to become mixed with it. The method adopted by the author consisted in exposing the bladder by laparotomy, cauterizing a small area of the wall of the bladder, and withdrawing the urine by means of a fine-pointed needle. The experimental animals were rabbits and guinea pigs. From a series of such experiments the author concludes that the kidneys and liver are impermeable to bacteria introduced into the organism by either intravenous or hypodermic methods. In cases where colonies of the micro-organism which were injected into the experimental animal developed in test tubes this micro-organism has become mixed with the bile or urine by means of a mechanical injury to the surrounding tissues produced in securing this substance for examination.

The rapidity of growth of the tubercle bacilli, P. RÖMER (*Centbl. Bakt. u. Par., 1. Abt., 27 (1900), No. 20–21, pp. 705–709*).—The author found during experiments in cultivating tubercle bacilli on different media that the most rapid growth was produced in a culture media in which the tubercle bacillus became covered with a slimy film.

The growth of the tubercle bacillus on acid brain culture media, M. FICKER (*Centbl. Bakt. u. Par., 1. Abt., 27 (1900), Nos. 14–15, pp. 504–511; 16–17, pp. 591–597*).—During extensive investigations carried out by the author it was found that the tubercle bacillus made a more vigorous growth on acid culture media prepared from sputum, potatoes, blood serum, and various organs of the human and animal body than upon neutral or alkaline culture media prepared from the same substances. On acid brain culture media, consisting of agar or serum and brain substance, the tubercle bacillus seemed to find especially favorable conditions for rapid and intense growth.

The influence of the organism of cold-blooded animals on the bacillus of human tuberculosis, V. SION (*Centbl. Bakt. u. Par., 1. Abt., 27 (1900), No. 20–21, pp. 710–720*).—The author's experiments indicated clearly that the tubercle bacillus does not produce any of the characteristic lesions of tuberculosis in frogs. The bacillus does not become generally distributed through the body of these animals. The author maintains that the tubercle bacillus does not undergo any changes in

form or character while living for a considerable time in the body of frogs. It was impossible to note any such changes in the bacillus after remaining from 6 to 9 months in the organism of the frog. The pathological properties of the tubercle bacillus were not modified by this long sojourn in the frog. Experiments showed that bacilli which had remained 6 months in the peritoneal cavity of the frog caused death from generalized tuberculosis in the guinea pig at the usual time after inoculation.

Generalized tuberculosis in the horse, J. M. KNIPSCHEER (*Tijdschr. Veeartsenijk en Veeteelt, 27 (1900), No. 2, pp. 162-167*).—A discussion of clinical symptoms and *post-mortem* findings.

The susceptibility of the ass to tuberculosis, V. GALTIER (*Jour. Méd. Vét. et Zootech., 5. ser., 4 (1900), pp. 77-82, figs. 2*).—It has long been known that the ass possesses a high resisting power to tuberculosis. During experiments which were conducted by the author it was found that of 11 asses which were inoculated in the jugular vein with tubercle bacillus all became infected, and 8 died. The other 3 recovered. The author concludes that, although the ass is very resistant to this disease, it may become infected naturally or experimentally.

The diagnostic and therapeutic significance of tubercle bacilli and other bacteria in sputum, L. BRIEGER (*Berlin. Klin. Wchnschr., 37 (1900), No. 13, pp. 272-274*).—Notes on the frequency of tubercle bacilli in the sputum of tuberculous patients.

Tuberculins and their use, E. A. DE SCHWEINITZ (*Jour. Amer. Med. Assoc., 34 (1900), No. 15, pp. 898-900*).—The author describes the difference in the methods of production and the nature of the old and new tuberculins. It is stated that the prospect of using the products of the tubercle bacillus freed from necrotic principles for the treatment of incipient tuberculosis is somewhat encouraging.

Tuberculin, and the early diagnosis of tuberculosis, B. FRÄNKEL (*Berlin. Klin. Wchnschr., 37 (1900), No. 12, pp. 255-258*).—A discussion of the value of tuberculin in the practice of human medicine.

Morphological changes in anthrax bacillus during its dissolution by pyocyanase, R. EMMERICH and SAIDA (*Centbl. Bakt. u. Par., 1. Abt., 27 (1900), No. 22-23, pp. 776-787, pl. 1*).—The authors experimented with a proteolytic enzym obtained from *Bacillus pyocyaneus*. A study was made of the effect of this enzym upon a number of pathogenic bacteria, but the anthrax bacillus was finally selected as being the most favorable for this study. From inoculation experiments the authors believe it was demonstrated in the case of anthrax that a cure or artificial immunity is brought about by the dissolution of the specific bacteria by means of bacteriolytic enzyms. It has generally been believed that these enzyms exist only in the animal body. The authors were able, however, to produce the substances artificially.

A method of curing anthrax in horses, M. L. YUDIN (*Arch. Vet. Nauk., 30 (1900), No. 6, III, pp. 106-110*).—The author gives a description of a method of curing anthrax in horses which was adopted in the Russian fifth army corps in 1830. Good success is reported from the application of this method.

New experiments in vaccinating reindeers, N. I. EKKERT (*Arch. Vet. Nauk., 30 (1900), No. 4, II, pp. 145-194*).—The author conducted an extensive series of experiments in immunizing reindeer against anthrax. As a result of these experiments, it is concluded that it is possible to confer immunity against anthrax upon reindeer by means of vaccination. In the extensive tundra regions of the government of Archangel a method for producing immunity is required which can be applied on a large scale and in a rapid manner. The veterinary department is engaged in solving the problems presented by these peculiar conditions.

Malignant catarrhal fever of cattle, O. OPPENHEIM (*Berlin. Tierärztl. Wchnschr., 1900, No. 8, pp. 87, 88*).—From a careful study of a number of cases of this disease

the author believes that many supposed cases of cerebral inflammation are identical with catarrhal fever.

Methods of fighting contagious pleuro-pneumonia of cattle, M. G. TARTAKOVSKY and E. P. DZHUNKOVSKI (*Arch. Vet. Nauk, 30* (*1900*), *No. 5, II, pp. 213–232*).—A report of experiments with vaccine, methods for the treatment and prevention of this disease, together with a study of the micro-organism.

Tick heart water experiments, C. P. LOUNSBURY (*Agr. Jour. Cape Good Hope, 16* (*1900*), *No. 11, pp. 682–687*).—The author conducted experiments for the purpose of determining the means by which heart water is communicated from one animal to another. The results obtained from these experiments indicate that the transmission of the disease is brought about by the agency of the bont tick (*Amblyomma hebraeum*). The evidence obtained with regard to *Rhipicephalus evertsi* was not conclusive.

The plague, P. RUBAY (*Ann. Med. Vet., 49* (*1900*), *No. 2, pp. 81–87*).—A discussion of the antipest-serum treatment, of the relative degree of immunity possessed by different organisms toward this disease, and on the agency of various animals as carriers of the plague.

Tag-sore in Algeria, NOCARD (*Rec. Med. Vet., Paris, 8. ser., 7* (*1900*), *No. 4, pp. 86–90*).—The author calls attention to the fact that this disease is apparently always present in Algeria, and believes that this is partly due to the fact that the disease assumes an unusually mild form in Algeria.

Enzootic occurrence of cancer in animals, R. BEHLA (*Berlin. Tierärztl. Wchnschr., 1900, No. 10, pp. 109–113*).—The author gives a statistical account of the increasing prevalence of cancer in different countries. Attention is called to the many unsolved problems in connection with the etiology of malignant tumors in animals and man and to the importance of solving these problems as soon as possible.

Hog-cholera remedies, H. H. NICHOLSON (*Nebraska Sta. Rpt. 1899, pp. 43–45*).—Analyses are reported of a number of worthless patent remedies which have been proposed for the cure of hog cholera.

A case of chronic glanders in man, R. VON BARAZC (*Arch. Path. Anat. u. Physiol.* [*Virchow*], *159* (*1900*), *No. 3, pp. 491–520, pl. 1*).—A bacteriological and pathological examination of a chronic case of glanders in man, together with a discussion of the literature of the subject and a bibliography.

The recurrence of glanders, LEBLANC (*Rec. Med. Vet. Paris, 8. ser., 7* (*1900*), *No. 4, pp. 80–85*).—This article contains observations on the recurrence of glanders after apparent recovery or after mallein injections have failed to produce reaction. The author believes that mallein, although a very reliable agent for detecting glanders, is not infallible, since many cases have been observed where glanders has developed in horses after they had ceased to react to the mallein test.

The resistance of rabies virus to putrefaction, S. VON RATZ (*Centbl. Bakt. u. Par., 1. Abt., 27* (*1900*), *No. 24, pp. 825–827*).—The author's experiments consisted in the production of acute cases of rabies in experimental animals and the inoculation of other animals with material taken from the brain of the first series of animals at periods of different lengths after death. The results indicate that rabies virus resists the action of putrefaction for a long time, but that its virulence is gradually modified.

The influence of injections of normal nerve substance on canine rabies and rabies toxine, V. BABES (*Centbl. Bakt. u. Par., 1. Abt., 27* (*1900*), *No. 16–17, pp. 564–568*).—During the author's experiments on this subject it was found that injections of normal nerve substance had the effect of curing a large percentage of dogs which had been inoculated with attenuated rabies virus. A similar treatment was found to be beneficial to epileptic and melancholy people. It was shown, however, that although the development of rabies in dogs could be prevented by injections of normal nerve substance, this treatment did not confer immunity upon the dogs.

Poultry pests (*Agr. Gaz. New South Wales, 11 (1900), No. 3, pp. 213–220*).—Brief notes on the gapeworm, *Heterakis papillosa*, *H. inflexa*, diphtheritic roup, and a number of fleas, lice, and mites which infest poultry.

Favus in poultry, F. V. Theobald (*Jour. Bd. Agr. [London], 7 (1900), No. 1, pp. 17–19*).—A brief account of the etiology, symptoms, and treatment of this disease.

An infectious disease of ostriches, Marx (*Centbl. Bakt. u. Par., 1. Abt., 27 (1900), No. 24, pp. 822–824*).—The author gives the details of the appearance of a bacterial organism found in the blood of ostriches suffering from an apparently new infectious disease. Experiments with this organism showed that it was not especially virulent for pigeons, but that small birds and mice were very susceptible to its action. Small birds contracted the disease when fed pure cultures of the microorganism.

AGRICULTURAL ENGINEERING.

Irrigation and the associations syndicales, A. Chavard (*Ann. Agron., 26 (1900), No. 7, pp. 332–344*).—This paper discusses the importance of irrigation, especially in the south of France, and recommends that the construction of reservoirs and canals and the division and distribution of water be placed in the hands of the agricultural syndicates which are organized in different parts of France mainly for the purpose of the cooperative purchase of fertilizers, seeds, agricultural implements, and occasionally for insurance against losses from hail and from the death of stock. An instance of such management, which has been attended with highly satisfactory results, is cited in detail.

Observations on Chavard's paper, P. P. Dehérain (*Ann. Agron., 26 (1900), No. 7, pp. 344–347*).—In this note attention is called to the fact that France already has 22 large irrigation canals, many of which are very old, constructed at great cost and requiring 1,200,000 francs annually for their maintenance. These canals are capable of irrigating 254,641 hectares, but of this irrigable area only 51,122 hectares is actually irrigated. In other words, only one-fifth of the water supplied by the canals is used. While admitting, therefore, the importance of increased provision for irrigation in many localities, the author suggests that more efforts should be directed toward disseminating information regarding the need and profits of irrigation.

Experiments in grinding with small steel feed mills, F. H. King (*Wisconsin Sta. Bul. 82, pp. 37, figs. 24*).—This bulletin records the results of something over 400 tests "to determine the rate at which feed for stock on the farm may be ground with several of the types of small steel mills now on the market; the power required to run them, and the approximate cost of grinding." The following mills were tested: (1) The O Aermotor grinder, used only with the 12-foot geared Aermotor windmill; (2) the N Aermotor grinder, designed for use with the 16-foot geared Aermotor windmill; (3) the No. 3 Appleton Prize Pulley Mill; (4) the No. 2 Bowsher; (5) the Giant; (6) No. 0 Ideal; (7) the No. 6 Smalley Monarch; and (8) the Vessot Little Champion.

"The powers used to drive the several grinders were (1) a 5-horsepower horizontal Fairbanks gas engine; (2) a 2½-horsepower Webster vertical gas engine; (3) a 16-foot geared Aermotor windmill, and (4) a 12-foot geared and roller-bearing Aermotor windmill. . . .

"The two engines were able to show very nearly their rated capacity by brake tests made upon the countershaft from which all of the mills except No. 1 were driven. An adjustable platform was provided upon which the several mills could be placed so as to be driven under every way like conditions. The fuel used by the engine was the city illuminating gas, costing $1.25 per 1,000 cubic feet, and the amount used was measured with a meter placed next to the engines. The wind velocities under which the windmill trials were made were obtained with the aid of a Robinson anemometer. . . .

"In each trial an effort was made to regulate the feed so as, if possible, to fully load the power which was being used at the time. This, however, could not always be done with the 5-horsepower engine, especially when the coarser grades of meal were being ground. The usual practice was to start the mill with grain enough in the hopper to get it regulated and adjusted to the engine and, at a signal, as the last of this left the hopper, a weighed quantity of grain was placed in the mill and the exact time required to run it through noted, together with the amount of gas consumed or the miles of wind passing the windmill. . . .

"To secure a reliable basis of judgment for estimating the amount of work done in each grinding trial it was necessary to know the degree of fineness of meal produced as well as the amount ground in a unit of time. . . .

"In the trials of grinding corn an effort was made to produce four grades of meal, (1) very coarse, suitable for feeding sheep; (2) coarse; (3) medium, suitable for cattle, and (4) fine, suitable for hog feeding. . . .

"The first degree of fineness was such as would not pass a screen of 8 meshes to the inch; the second that passing a screen of 8 but stopped by one of 10 meshes; the third that which would pass a screen of 10 meshes but be stopped by one of 16 meshes to the inch, while the fourth grade was that passing the screen of 16 meshes to the inch."

With the O Aermoter grinder and 12-foot roller-bearing Aermotor windmill the rate of grinding in case of corn was "about 25 bu. per hour with a wind velocity of 31.8 miles, the meal being a little coarser than 'medium.' Corn and oats were ground at the rate of 410.3 lbs. per hour with the wind at 26.48 miles. With a wind velocity of 26.67 miles oats were ground at the rate of about 5.5 bu. per hour and rye at the rate of 15.35 bu. with the wind 25.35 miles. The rye was ground a little finer than 'medium' and the oats a little coarser."

From data recorded in this and in a previous bulletin (E. S. R., 10, p. 695) it appears that between October 1 and May 1—

"There were 87 days when a man could attend the mill and grind 10 hours with a wind velocity not less than 15 miles per hour, and much of the time higher than this. He should therefore be able to grind more than 46 bu. per day and on the average more than 100 bu. per week. The 87 grinding days, during the 7 months, places the grinding days, on the average more than two per week, and if it is supposed that this is twice too high it would still be possible on the average to take advantage of high winds during the working hours and grind about 50 bu. of corn, or 2,800 lbs. per week. Counting the man's time who tends the mill $1 per day, the cost of grinding would be only about 3½ cts. per cwt.

"Some grinding of other grains than corn with the 12-foot windmill was also done,

but the number of trials was limited. With corn and oats, half and half by measure, the rate was 4,103 lbs. per 10 hours with a wind of 26.48 miles per hour. This is 93¼ bu. per day of 10 hours.

"In grinding clear oats four trials were made with wind velocities of 19.46, 23.38, 24, and 26.67 miles per hour, and 10 hours' work at the observed rates would represent a grinding of 38.7, 50.2, 45.6, and 54.6 bu., respectively. At wind velocities of 25.35 and 25.18 miles per hour rye was ground at the rates of 153.4 and 136.8 bu. per 10 hours."

The observed work performed by the mill was found to agree fairly well with that calculated on the assumption that the effective energy of the mill increased with the square of the velocity of the wind for velocities between 7 and 36 miles per hour.

The results of the trials of the X Aermotor grinder and 16-foot windmill show "that up to 20 miles per hour of wind velocity the capacity of the 16-foot windmill was materially greater than that of the 12-foot wheel; but at higher velocities the reverse is true."

None of the other mills were as effective with the windmills as the grinders especially designed for them.

The results obtained with the other mills, using 2½ and 5-horsepower engines as the motive powers, are summarized in the following table:

The computed number of bushels of grain ground to a grade of 45 per cent of the finest degree in 10 hours, together with the cost of fuel for the same time.

Name of mill.	5-horsepower engine.		2½-horsepower engine.	
	Bushels per 10 hours.	Cost of gas per 10 hours.	Bushels per 10 hours.	Cost of gas per 10 hours.
Corn:				
Appleton	254.6	$1.71	130.3	$0.88
Bowsher	278.5	1.81	128.0	.89
Giant	255.4	1.67	110.3	.88
Ideal	203.6	1.72	114.6	.92
Monarch	190.8	1.74	104.3	.88
Vessot	311.1	2.04	114.0	.89
Average	249.0	1.78	116.6	.89
Corn and oats, average of all mills	239.3	1.94	95.0	1.01
Oats, average of all mills	113.4	1.66	70.2	.96
Rye, average of all mills	157.0	1.72	58.5	.78

"It will be seen from this table that as an average of all the grinding trials with the 5-horsepower engine the cost of fuel per day was $1.775, and for the 2½-horsepower engine, $0.885. This is at the rate of 3.55 cts. and 3.54 cts. per horsepower per hour for fuel where gas costs $1.25 per thousand cubic feet.

"The average amount of corn ground per horsepower per hour was 4.822 bu., equal to 270 lbs., and this is 2,700 lbs. per horsepower for a 10-hour day."

It is estimated that at the rates ordinarily paid the grinding of feed for 30 cows for 200 days amounts to about $57; the same amount of feed may be ground with a 5-horsepower engine, under the conditions obtaining in these trials, for about $13.50.

It is stated that $57 "is 10 per cent interest on a much larger sum than would be required to fit up an automatic grinding plant with the

12-foot windmill, the price of the mill and 90-foot tower being $160, and the capacity of such a grinding plant would be many times what would be demanded for a herd of 30 cows."

Silage and the construction of modern silos, F. H. KING (*Wisconsin Sta. Bul. 83, pp. 68, figs. 28*).—This bulletin discusses the value of silage as a feeding stuff; the essential conditions for preserving silage; the details of construction, cost, and efficiency of silos of different kinds; the selection and culture of crops suitable for ensiling; the preparation of silage; and the losses which occur in the preparation and feeding of silage.

"The problems of silage and silo construction have been studied now continuously for nearly 10 years. Two bulletins on the subject have been issued [E. S. R., 9, p. 393], and the present one embodies the knowledge which has been gained through a personal inspection of more than 200 silos, one-half of which were visited the past year, together with the conclusions regarding the essential conditions necessary to the making and preserving of good silage which have been reached through experimental studies extending over 7 years."

The cylindrical silo has generally proved most satisfactory. Various types of it, constructed of brick, stone, and wood, and lined and ventilated in different ways, as well as stave, pit, and rectangular silos, are described.

It appears that the unavoidable loss, *i. e.*, "the loss of feeding value which can not be prevented in the interior of a silo with air-tight linings when filled in the best practicable manner," may be as low as 2 to 4 per cent and in good practice need not exceed 4 to 8 per cent. An account is given of comparative experiments on this point with 3 types of silos—(1) a silo (with doors) made of Washington cedar staves accurately beveled and tongue-and-grooved, (2) a silo (without doors) made of 2 by 4 pine staves not beveled or tongue-and-grooved, (3) a galvanized iron cylinder with water-tight bottom and sides. The first and second silos were without bottoms, but stood on a level cement floor. The silos were filled with corn, cut in short pieces, at the same time and in the same way.

"When full, the silos were covered with 3 layers of acid and waterproof paper cut to a circle to fit closely, and upon this was placed a layer of sand about 5 in. deep. The silos stood in the warm plant house from August 29 until March 1, when they were opened."

The losses from the top layers of silage in the 3 silos were 50.75, 49.71, and 9.21 per cent, respectively; middle layers, 13.15, 14.98, and 7.01 per cent; bottom layers, 31.75, 26.16, and 0.51 per cent.

"The large losses from the bottoms of the two stave silos were due to air entering between the ends of the staves and the cement floor, and the greater losses from the [cedar stave] silo at both the bottom and top were due to the additional leaks about the doors.

"The metal silo was absolutely air-tight everywhere except at the top, and the three cases illustrate in an extremely forceful way how important it is to exclude the air from the silage.

"[In an 80-ton silo with galvanized-iron lining] there was lost only 6.38 per cent of the dry matter put into it in 1897, including that spoiled on the top and above the doors, but only 3.66 per cent of that below the 2 surface layers. Even in the small 1,580-pound metal silo the total loss, including that spoiled on top, was but 8.57 per cent, while the mean loss from the middle and bottom layers was only 5.3 per cent, and yet the silage had stood under the conditions of summer temperature and sun during 180 days.

"The observations with these silos prove that where the linings are strictly air-tight very small losses need be sustained even in small silos and that when the air is not excluded the losses must increase in proportion to the openness of the silo lining."

Attention is called to the loss which occurs at the top of silos and that due to slow feeding.

"The data which have been collected show that silos left without covers of any sort from early September until March without being disturbed develop about 28 lbs. of spoiled silage per square foot of surface, while silos opened from the middle of October to the middle of December have an average of about 16 lbs. of spoiled silage per square foot of surface. These rates give 2,832 and 4,956 lbs. of loss for a silo 15 ft. in diameter, which is 1.4 and 2.5 per cent on 100 tons of silage. . . .

"Next to the losses due to the surface decay between filling and opening the silo the most serious one is that which is due to too slow feeding."

Rise and future of irrigation in the United State, E. MEAD (*U. S. Dept. Agr. Yearbook 1899, pp. 591-612, pls. 5*).—The topics discussed in this article are: Remains of ancient irrigation works, early irrigation in California, beginnings of modern irrigation, objections to corporate canals, water-right problems of the arid regions, the appearance and resources of the arid regions, present and future of irrigation, and the commercial importance of irrigation.

Progress of road building in the United States, M. O. ELDRIDGE (*U. S. Dept. Agr. Yearbook 1899, pp. 367-380, pls. 4*).—This is a review of the history and present status of road building in the United States and includes discussions of the following topics: Road methods of the first settlers, forced-labor system and roads of the early colonists, inauguration of turnpike roads by chartered companies, era of speculation and restoration of forced-labor system, national highways, introduction and development of steam railroads, difficulties of transportation and of travel, establishment of the Office of Public Road Inquiries, and progress of the movement in the United States for good roads.

Soiling, ensilage, and stable construction; being a revised edition of Soiling, summer and winter, F. S. PEER (*New York: M. F. Mansfield, 1900, pp. 247, figs. 34*).

STATISTICS—MISCELLANEOUS.

Annual Report of Minnesota Station, 1899 (*Minnesota Sta. Rpt. 1899, pp. XX+670*).—The report proper contains a financial statement for the fiscal year ended June 30, 1899, and a detailed review of station work during the year. Meteorological observations are given and Bulletins 60-64 of the station, treating of the following subjects, are reprinted: Beef cattle and swine (E. S. R., 11, p. 175); butterflies and moths injurious to our fruit-producing plants (E. S. R., 11, p. 170); wheat—varieties, breeding, cultivation (E. S. R., 11, p. 638); miscellaneous analyses (E. S. R., 11, p. 812); composition of tomatoes (E. S. R., 11, p. 843); proteids of wheat flour (E. S. R., 11, p. 872); black or summer rust of wheat (E. S. R., 11, p. 861); and Hessian fly, migratory locusts or grasshoppers (E. S. R., 11, p. 864).

Thirteenth Annual Report of Nebraska Station, 1899 (*Nebraska Sta. Rpt.

1899, pp. 171).—This contains the organization list of the station; a report of the acting director on the staff, equipment, publications, and work of the station; a financial statement for the fiscal year ended June 30, 1899; and reports of the heads of departments, parts of which and several miscellaneous articles included in the report are abstracted elsewhere.

Agricultural experiment stations in the United States, A. C. True (*U. S. Dept. Agr. Yearbook 1899, pp. 513–548, pls. 3*).—This is an account of the history organization, equipment, lines of investigation, and the general results of the work of the experiment stations, together with an account of early experimental work by agricultural colleges and other institutions, a discussion of the relations of the stations to the Federal Government and to several associations, and an account of the establishment and work of this Office.

Agricultural experiment stations in the United States, A. C. True (*U. S. Dept. Agr., Office of Experiment Stations Circ. 44, pp. 8*).—A general review of the history and organization of the stations, with tables showing their location, directors, principal lines of work, and revenues for the fiscal year ended June 30, 1899.

Progress of agriculture in the United States, G. K. Holmes (*U. S. Dept. Agr. Yearbook 1899, pp. 307–334*).—A general and statistical review of the development of agriculture in the United States, from the crude beginnings by the Indians until the present time.

Yearbook of the Department of Agriculture, 1899 (*U. S. Dept. Agr. Yearbook 1899, pp. 880, pls. 63, figs. 33*).—This consists of a general report by the Secretary on the operations of the Department during the year, 26 papers, noted elsewhere, reviewing for the most part the progress in agricultural science in the United States during the nineteenth century, and the usual summary of useful information on various subjects of interest to the farmer published in the form of an appendix.

Proceedings of the Agricultural Students' Association, 1899–1900 (*Nebraska Sta. Bul. 64, pp. 85–107*).—The proceedings of the association at its February meeting, including reports on home reading courses and on cultural experiments with corn (see p. 442), are given. Suggestions are made for experimental work to be carried on under the supervision of the heads of different departments of the college.

Agricultural education in the United States, A. C. True (*U. S. Dept. Agr. Yearbook 1899, pp. 157–190*).—An outline of the origin and development of the system of agricultural education in the United States is given as an introduction to the article, the main purpose of which is "to present a general view of the different agencies for education in agriculture in this country as they exist at the close of the nineteenth century, and to indicate the directions in which the movement for the diffusion of knowledge on agricultural subjects among our people is tending."

Development of transportation in the United States, A. Sinclair (*U. S. Dept. Agr. Yearbook 1899, pp. 643–663*).—An historical account of the beginning and development of railroads in the United States, including a discussion of passenger traffic; a statistical review of the increase in population, agricultural production, and railroad mileage; a discussion of freight and passenger rates; and other topics connected with transportation.

Our foreign trade in agricultural products, 1890–1899, F. H. Hitchcock (*U. S. Dept. Agr., Section of Foreign Markets Bul. 19, pp. 62*).—This is a statistical review of the foreign trade of the United States in agricultural products during the 10 fiscal years, 1890–1899.

Development of agricultural libraries, C. H. Greathouse (*U. S. Dept. Agr. Yearbook 1899, pp. 491–512, pls. 4, fig. 1*).—This gives an account of agricultural books in college, general, and private libraries in the United States at the beginning of this century, traces the growth of agricultural libraries, gives a descriptive account of the agricultural libraries of the present time, and offers suggestions for permanent libraries for farmers.

A classification of the literature of agriculture enlarged from the decimal classification of Melvil Dewey, J. I. WYER (*Nebraska Sta. Rpt. 1899, pp. 91–121*).—"This classification of the literature of agriculture is the result of an attempt to arrange satisfactorily, in minute subject order, the literature on agricultural topics which has accumulated at the University of Nebraska library during the past 10 years." The classification includes nearly 600 heads, and is designed to provide for the most specialized agricultural literature, except in the department of floriculture. An index is added.

Bulletins of Alabama Station (*Index to Vol. VII, Buls. 101–107, pp. 425–452*).

The new agriculture of the tropics, G. E. W. (*Sci. Amer., 83 (1900), No. 5, p. 67*).—A discussion of the agricultural products of the tropics and the improvement of soils and plants by the application of scientific methods.

Danish agriculture in 1899, R. SCHOU (*Tidsskr. Landökon., 1900, No. 1, pp. 1–26*).

Crops in Denmark in 1899, K. HANSEN (*Tidsskr. Landökon., 1900, No. 2, pp. 46–74*).

Agricultural syndicates in France, H. W. WOLFF (*Jour. Roy. Agr. Soc. England, 3. ser., 11 (1900), pt. 2, pp. 252–262*).—Popular article pointing out the benefits to French agriculture of the formation of cooperative societies among the farmers for the purchase of seeds, fertilizers, farm implements, feeds, etc., needed by farmers, and for the sale of farm products.

NOTES.

Colorado College and Station.—Carl H. Potter, assistant in horticulture, has been granted leave of absence for one year on half pay. Mr. Potter will remove to the vicinity of Grand Junction, and will there act as field agent and investigator for the agricultural college. The resignation of C. F. Mergelman as florist has been accepted, to take effect January 1. Joseph Lownes, who has for two years been assistant chemist at the station, died December 9. A short course of two or three weeks for canal superintendents and State water commissioners has been authorized by the State board of agriculture, to be given in the spring. This is intended to give them fuller knowledge of their duties in the distribution of water, which is an important part of their work.

Georgia Station.—This station is erecting a greenhouse in addition to the propagating house already in use, and will undertake investigations and experiments in winter forcing of vegetables, etc., and such lines of biological work as require such facilities.

Iowa College and Station.—The main building of the agricultural college, one of the oldest on the campus, was destroyed by fire December 8, 1900. The building contained the botanical department of both the college and station, which suffered heavily. The Parry herbarium was saved, except the duplicates, which were nearly all burned. A part of the grass collection was saved and a few of the other specimens. The general collection contained about 80,000 specimens, more than 50,000 of which were burned, besides several thousand duplicate specimens. This collection included many Western plants, representing four years of collecting, and sets of plants from Porto Rico, Cuba, and Mexico. Much of the library of the botanical department, as well as the private library of the botanist, was destroyed, and most of the microscopes and other apparatus were burned. A manuscript on the grasses of the State and one on thistles were also lost, together with a number of smaller papers ready for publication.

Kansas College and Station.—Tait Butler has been elected to the chair of veterinary science made vacant by the resignation of Paul Fischer.

New Mexico College and Station.—All departments of the college and station were represented in the exhibit made at El Paso during the midwinter carnival in January. The biological department of the college has received a large amount of zoological material, principally for study and dissection by students, which makes its equipment in these lines by far the best in the Territory. One of the finest wild roses in America has been discovered and described by the station botanist, having been found growing wild in the Organ and Sacramento mountains. Not long since a small weed, growing profusely on the mesas and in the valleys, was found to possess qualities which apparently make it valuable as a substitute for litmus, and it is more than possible that this little weed can be demonstrated to be valuable to commerce.

Tennessee University and Station.—M. Jacob, V. M. D., a graduate of the veterinary department of the University of Pennsylvania and formerly house surgeon of that institution, and more recently connected with the meat-inspection service of the Bureau of Animal Industry of this Department, has been appointed instructor in veterinary science at the university and consulting veterinarian of the station.

National Irrigation Congress.—The ninth annual session of the National Irrigation Congress was held in Chicago, Ill., November 21–24, 1900. There were in

attendance about 200 delegates, including several representatives of this Department. Elwood Mead, expert in charge of irrigation investigations of this Department, presided and delivered the presidential address. In this he briefly reviewed the origin and the history of the Irrigation Congress, and discussed the relation of the great irrigation problems to the States and to the nation. He advocated the union of land and water under one control, and he pointed out that many of the great irrigation questions were not solely State questions but that "there are certain matters which only the nation can deal with." The settlement and development of the irrigated region "requires new laws for the distribution of the irrigable lands to the people" and laws for the division of the waters of rivers between the States. "The work which lies before us is beyond the means of local effort or individual enterprise. The adjustment of the diverse and conflicting interests of individuals, communities, and different States requires not only wise national laws, but administrative ability of high order in their execution. The framing of these laws is a task which ought not much longer to be deferred."

Special prominence was given in the session to the question of the storage of water. Resolutions were adopted urging upon Congress that "national appropriations commensurate with the magnitude of the problem should be made for the preservation of the forests and the reforestation of denuded areas as natural storage reservoirs, and for the construction by the National Government, as part of its policy of internal improvement, of storage reservoirs and other works for flood protection, and to save for use in aid of navigation and irrigation the waters which now run to waste, and for the development of artesian and subterranean sources of water supply. The waters of all streams should forever remain subject to public control, and the right of the use of water for irrigation should inhere in the land irrigated, and beneficial use be the basis of measure and the limit of the right." The work of the various branches of the National Government in the investigation of problems relating to irrigation was commended, and the necessity of providing liberal appropriations for this important work was emphasized. The officers chosen for the ensuing year are as follows: Thomas F. Walsh, Washington, D. C., president; J. B. Prince, New Mexico, first vice-president; F. B. Thurber, New York, second vice-president; H. B. Maxon, secretary.

MISCELLANEOUS.—There has been begun by Dr. Alexander Ramsey a bibliography, guide, and index to the bacteria. It is published in *The Scientific Roll and Magazine of Systematized Notes*, the first number of which appeared in October, 1900. The conductor of the magazine requests all authors on bacteriological subjects to communicate with him in care of R. L. Sharland, publisher, 38 Churchfield Road, Acton, London, W., England.

E. Rathay, professor and director of the Œnological and Pomological Station of Klosterneuburg, Austria-Hungary, died September 9, 1900, in his fifty-sixth year.

Prof. A. B. Frank, professor of botany in the Agricultural High School at Berlin and director of the biological division of the imperial board of health, died recently at the age of 61 years.

Thomas A. Williams, assistant chief of the Division of Agrostology of this Department, died suddenly at his home December 23, 1900, of heart trouble. Professor Williams had been connected with the Division of Agrostology since 1896, and through his ability and industry had risen to an important place in its activities. He was widely known among botanists and station workers, by whom he was regarded as an efficient and untiring worker in his chosen field, and was highly esteemed.

W. P. Cutter, for several years past Librarian of this Department, has resigned to accept a position in the Congressional Library. He has been succeeded by Miss Josephine A. Clark, formerly assistant Librarian.

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EXPERIMENT STATION RECORD.

Editor: E. W. ALLEN, Ph. D., *Assistant Director.*

EDITORIAL DEPARTMENTS.

Chemistry, Dairy Farming, and Dairying—The Editor and H. W. Lawson.
Meteorology, Fertilizers and Soils (including methods of analysis), and Agricultural Engineering—W. H. Beal.
Botany and Diseases of Plants—Walter H. Evans, Ph. D.
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Entomology and Veterinary Science—E. V. Wilcox, Ph. D.
Horticulture—C. B. Smith.
With the cooperation of the scientific divisions of the Department and the Abstract Committee of the Association of Official Agricultural Chemists.

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SEEDS—WEEDS.

DISEASES OF PLANTS.

LIST OF PUBLICATIONS ABSTRACTED.

EXPERIMENT STATION RECORD.

Vol. XII. No. 6.

"A scientific bibliography is for facts what a dictionary is for words." This is the estimate of M. E. Duclaux, director of the Pasteur Institute, in his introduction to the *Bibliographia lactaria* of Henri de Rothschild, which has just been issued. This is probably the most complete and systematic bibliography of milk which has ever been prepared. It contains 8,375 titles, arranged by subjects, with the entries in chronological order under each subject; an author index with reference to the papers by number, and a chronological list of inventions of apparatus for handling and treating milk.

The review of literature goes back to the beginning of the sixteenth century, the oldest paper cited bearing the date of publication of 1500. The American work is very fully represented, the references cited indicating a surprising amount of research of American literature and great familiarity with the sources of publication.

The amount of labor involved in the preparation of such a bibliography can scarcely be realized. Dr. de Rothschild has of course had the aid of a corps of assistants, and enjoyed splendid library facilities. His own private library is said to be the most complete in dairy literature to be found anywhere. The value of such a bibliography to the investigator or the writer will be readily appreciated. It makes accessible for all time the principal literature relating to the subject which has been published during four centuries. The value of the undertaking is enhanced by the expressed purpose of the author to issue an annual supplement to this volume, covering the current literature.

The preparation of bibliographies of subjects related to agriculture has received an increasing amount of attention in recent years. This attention is well merited, for perhaps in no other line are the articles more widely scattered. The collection of these papers in a systematic and thorough manner adds very greatly to the facilities of the investigator in agricultural science, and the use of such bibliographies becomes more and more desirable as our research progresses. Appreciating the importance of such bibliographical helps, the National Department of Agriculture has of late issued a number of important contributions. Among these the index to literature relating to animal industry, by G. F. Thompson, is especially noteworthy. This is an index to the bulletins and reports issued by the Department of Agriculture from

its establishment in 1837 to the close of 1898. It contains 676 pages, with some 80,000 entries. It covers a wide range of subjects relating to domestic animals, their care and management, diseases and treatment, together with animal products, such as milk, butter, cheese, eggs, wool, meats, etc. This volume, together with the Handbook of Experiment Station Work, which is in process of revision, will furnish a very complete record of the work done by the Department and the experiment stations along these lines.

Two new abstract or bibliographic journals of interest to station workers have recently made their appearance. The first of these is announced as a bibliography, guide, and index to bacteria, and is entitled the *Scientific Roll and Magazine of Systematic Notes*. The editor is Dr. Alexander Ramsey, of England. The great interest which at present attaches to work in bacteriology in its different lines should make such a journal in English a welcome addition to the current periodical literature.

The other journal referred to is the *Geologisches Centralblatt*, devoted to the publication of reviews of contributions in geology and all related sciences. The abstracts are printed in German, French, or English. The journal will appear semimonthly, and is under the editorial management of Dr. K. Keilhack, of Berlin, who has associated with himself a long list of collaborators representing different countries.

Another new monthly periodical, dating from the beginning of the present year, occupies a quite novel field and indicates the extent to which specialization in periodical literature is being carried. It is devoted to the subject of hail and the protection of crops from it (*La Grêle et la Défense des Récoltes*). Much attention is being given to this in the vine-growing regions of France, Italy, and Austria. It is estimated that the loss from hail during the eight years from 1890 to 1897 amounted in the Department of Rhône alone to over $9,000,000. Systematic cannonading with a smoky powder has been recommended and quite extensively adopted as a means of dispersing destructive hail storms. This practice was first adopted in Italy, and was introduced into France in 1899. The cannonading stations are established and maintained at private expense. The most systematic organization of stations is at Denicé, near Villefranche, where 52 cannon covering an area of 1,000 hectares (nearly 2,500 acres) are operated.

The new journal is a monthly, and is published in the interest of viticulturists who have taken active measures in the direction of hail protection. The initial number contains, in addition to the plan and purpose of the journal, an account of the Hail Protection Congress held at Padua, Italy, November 25–28, 1900, a reprint of an old article on cannonading to dissipate storms, published in 1760, and a reprint of an article by Gastine and Vermorel which is to be noted later.

CONVENTION OF ASSOCIATION OF OFFICIAL AGRICULTURAL CHEMISTS, 1900.

D. W. May,
Office of Experiment Stations.

The seventeenth annual convention of the Association of Official Agricultural Chemists met in the lecture hall of the Columbian University, Washington, D. C., November 16, 17, 1900. Eighty-five members and visitors were in attendance. The meetings were presided over by the president, B. W. Kilgore.

In his address the president of the Association favored a national pure-food law, and suggested phases for the cooperation of the official agricultural chemists. The importance of a national standardizing bureau under government control was also emphasized. Under the subject of fertilizers the results of analyses, especially as printed on bags, the misleading naming of special brands, and the importance of a statement setting forth the materials composing the brands, were questions brought to the careful attention of the Association. The value and the results of individual effort in the development or improvement of methods of analysis were strongly brought out. As an example of this, the president cited the development of the method of estimating potash. Especial attention was called to the examination of human foods, and the importance was urged of placing the subject in subdivisions under experienced members of the Association.

Adjournment was taken to accept an invitation of the National Grange to attend a meeting of that order then in session in the city.

FERTILIZERS.

The work on methods of fertilizer analysis during the past year was confined to testing some of the newer methods not yet adopted by the Association, or some particular points in the official methods. No changes in the present methods were made, although several points were recommended for testing the coming year.

Potash.—The referee, L. S. Munson, being absent, the report on potash was read by the secretary. Samples were sent out for the purpose of testing the application of the method of determining water-soluble potash in fertilizers made up entirely or in part of organic material; also to ascertain whether in mixtures of acid phosphate and potash salts it was possible to obtain the theoretical amount of potash added.

Eleven analysts reported. The results obtained for water-soluble potash were very irregular, showing a variation of 0.47 per cent in a total of less than 2 per cent of potash present. In the case of obtaining the theoretical amount of potash in mixtures of acid phosphates and potash salts the results were more regular, but still showed a wide variation. The average of the results with the mixture gave 6.12 per cent of potash, while the theoretical amount was 6.35 per cent. Work along these lines will be continued.

H. A. Huston suggested that the loss of potash might have been occasioned by continued boiling, as reported by the Kentucky Station several years ago.

Nitrogen.—Owing to the continued bad health of the referee, F. S. Shiver, the report on nitrogen was presented by the associate, W. R. Perkins. The work has been limited to a study of methods for determining availability of organic nitrogen by the neutral permanganate (Street) and pepsin-hydrochloric acid (Jones) methods. While the work of the year has not materially approached the settlement of the question of the value of the two methods, the associate believed that by closely following certain points in manipulation as outlined the permanganate method can be made to give good results. It was suggested that the work on the two methods be continued.

Some of the work on availability of nitrogen carried on at the Rothamstead Experiment Station was discussed by Dr. Bernard Dyer.

A paper by W. A. Withers and G. S. Fraps on the Rate of nitrification of certain fertilizers was presented by the former. The experiments reported showed a very close correspondence between the rate of nitrification during 3 weeks and the availability as shown by chemical and vegetation tests, except in the case of sulphate of ammonia. The latter seemed to be nitrified much more slowly than the organic compounds, yet in many of the field experiments it gave results closely approximating those given by nitrate of soda. The nitrification of all materials tested, except bone, was facilitated by adding calcium carbonate. This investigation will be continued.

C. B. Williams presented a report on Variable ammonia results in mixed fertilizers. In tests of methods of analysis on fertilizers containing fish scrap, blood, tankage, or nitrate of soda, results showed that where the samples were put through a 1.25 mm. sieve (No. 20) the differences ranged from 0.27 to 1.96 per cent. When put through sieves of 0.625 mm. (No. 40) the differences ranged from only 0.02 to 0.14 per cent. In all these determinations the modified Kjeldahl method was used with 0.7 gm. of substance. It is hoped to supplement these results by further work during the coming season.

After some discussion on the added value of a fertilizer having its nitrogen in the form of nitrates, a motion was adopted expressing the

desirability of determining and reporting upon the forms of nitrogen in the analysis of commercial fertilizers.

The Jones and Street methods for nitrogen were recommended for further trial at the hands of the referee for next season.

Phosphoric acid.—The report was presented by the referee, E. G. Runyan. Results were reported from 19 analysts on the samples sent out for determination of the total phosphoric acid by the official gravimetric method, optional volumetric method, and volumetric by shaking at room temperature. In 16 reports the several methods agreed fairly well, and may be considered quite satisfactory.

Results on the determination of iron and alumina in phosphates were reported by 7 analysts. These were rather discordant, although agreeing more closely than the previous year. While the results reported on the determination of iron by the permanganate method do not agree very well, the referee believes this to be the best means for determining iron in phosphates. The results of tests of the acetate and the phenylhydrazin methods of alumina determination do not warrant the drawing of definite conclusions, but the referee believes that some form of the acetate method will prove to be the better.

H. J. Wheeler presented a paper upon Increased accuracy in phosphoric acid determination. In this he asked the special attention of the Association to the work of Gooch and Austin (E. S. R., 11, p. 107), and suggested certain modifications of the official method of determining phosphoric acid. By the proposed modification close approximations to theoretical results are obtained, and the laboratory is freed from the strong odor of ammonia and the expense materially reduced.

P. MacFarland read a paper on basic slag, in which he reviewed the sale of this material in Canada and the trials of the official chemists in the Dominion in establishing a proper valuation of the soluble phosphate content. He presented the results of certain modifications in the methods of analysis of this product, and asked the cooperation of the Association in the further study of the question. After some discussion the question of the adoption provisionally of the 2 per cent citric acid solution method of Wagner and the consideration of the paper presented was referred to the referee for another year.

C. B. Williams described Kilgore's modification of the volumetric method of estimating phosphoric acid. By this method 30 phosphoric acid samples may be analyzed with ease daily. From a large number of comparative tests with the gravimetric method the results were in all cases reported as extremely satisfactory.

SOILS.

The report on soils by the referee, B. L. Hartwell, covered the past 2 years. At the meeting in 1898 the Association recommended work upon the so-called international method of determining assimilable

potash by using dilute nitric acid as a solvent, a further trial of Hollemann's method for the determination of the active lime compounds by using water saturated with carbonic acid, and further tests with alkaline ammonium chlorid as a solvent for potash. The results of the work covering the period indicated were presented. The data, so far as obtained, do not justify drawing any definite conclusions and the work will be continued.

The referee also read a paper on A pot experiment to test field observations concerning soil deficiencies. Attention was called to the fact that often after a lapse of time a second analysis of a given soil failed to account for elements added in fertilizers or for amounts removed by crops. This difficulty was believed to be probably due to failure of the soil sample to properly represent the area from which it was taken. It was suggested that soils intended for field experiments should have applied to them other lacking ingredients than the one to be tested, and that soils intended for testing methods for determining assimilable plant food should be subjected to pot experimentation before being distributed by the referee.

After some discussion a recommendation was adopted instructing the referee on soils to consider methods for the mechanical analysis of soils and the statement of the results, and also to consider the method of soil sampling suggested by Dr. Dyer.

The following provisions were also adopted as official: The use of fifth-normal nitric acid as well as hydrochloric acid of the same strength in determining phosphoric acid; the employment of a 3 mm. sieve where 100 gm. or more of a sample is used for the determination; and the statement in the report of soil examination of such additional data as to enable calculating the total amount of the several ingredients in a given area of soil to the depth at which it was sampled.

LIQUOR AND FOOD ADULTERATION.

The report on liquor and food adulteration was presented by William Frear. No recommendations were made. A list of definitions adopted tentatively for certain classes of products was presented, and a collection of data of analyses of foods, condiments, and liquors. A resolution was adopted by the association placing the subject of liquor and food adulteration under fifteen heads, as follows: (1) meat and fish, (2) fats and oils, (3) cereal products, (4) infant and invalid foods, (5) saccharine products, (6) canned vegetables, (7) tea, coffee, cocoa, etc., (8) spices and condiments, (9) vinegar, (10) flavoring extracts, (11) fruit products, (12) fermented and distilled liquors, (13) baking powder and baking chemicals, (14) preservatives, and (15) coloring matters. The referee was authorized to associate with himself other members of the Association to investigate the several subjects and prepare reports.

ASH ANALYSIS.

The referee, A. E. Shuttleworth, outlined the work on ash and the method of procedure. Results were reported from 3 analysts. The writer stated that the place to begin the improvement of the method of analyses is in the preparation of the ash. Volatilization and fusion are two noteworthy sources of error. The use of calcium acetate solution overcomes the difficulty of fusion, and a closed platinum apparatus prevents volatilization. These were adopted by the Association as official. A paper by G. S. Fraps was submitted on the Loss of sulphur in preparing ash of plants. Two methods were tested. Ten grams of substance were burned alone at as low temperature as possible, and 10 gm. were burned after the addition of a solution of calcium acetate. In no case was all the sulphur of the plant contained in the ash, and the loss with the calcium acetate was from 6 to 100 per cent more than when the substance was burned alone.

FOODS AND FEEDING STUFFS.

The report was presented by W. H. Krug and covered the results for 2 years. Three samples consisting of wheat, bran, and peas were sent out. From the results obtained, three suggestions were made by the referee: (1) That the present methods for moisture be further studied with the view of fixing the time required and the exact temperature at which the determination must be made; (2) the further study of the effect of various methods of distillation on the results obtained by the phloroglucin method; and (3) the determination of the effect of the length of time which the precipitated distillate stands upon the amount of phloroglucin obtained.

G. S. Fraps presented Notes on the determination of pentosans and crude fiber. Attention was called to probable sources of error in the official method of distillation in determining pentosans, in the quality of phloroglucin used, and in the composition of the products obtained by distillation of pentosans with hydrochloric acid. A method devised by König was proposed for preparing crude fiber practically free from pentosans (E. S. R., 10, p. 411). A method of purifying phloroglucin was adopted; also several changes in manipulation in the provisional method for the determination of pentosans by means of phloroglucin.

DAIRY PRODUCTS.

In his report the referee on dairy products, J. B. Weems, outlined the work of the past year, which was the investigation of the official and provisional methods and their modifications in determining casein and albumen in milk. The results of the different analysts were presented and certain changes in the methods recommended. The Frear alum method was substituted for the magnesium sulphate method for determining the casein in milk.

E. E. Ewell presented a method for the determination of the specific gravity of fats. The question of making determinations at 100° C. instead of at the temperature of boiling water was referred to the referee for next year.

TANNIN.

The report on tannin was presented by O. Carr. W. H. Krug read a paper on Comparative hide-powder tests. He suggested that in addition to the present requirements a clause be inserted to the effect that the hide powder used in the determination of the nontannins shall be neutral.

A paper by H. W. Wiley and W. H. Krug reported results of a Comparison of the international filter-tube method and the official hide-powder method. The results show that the filter-tube method gives lower nontannins and correspondingly higher tannins than the official method. Attention was called to the necessity, in the interest of commerce, of a uniform international method.

The use of the centrifugal and the pasteur filter in the estimation of tannin was adopted.

FUNGICIDES AND INSECTICIDES.

The report of the associate referee, L. A. Voorhees, consisted largely of a further compilation of methods. The methods of 13 analysts were given in full, and they were adopted provisionally for trial and comparison in actual analytical work.

No report on sugar analysis was rendered by the referee on that subject. The referee for next year was instructed to investigate and report upon the relative value of the present official method and the German method for the optical determination of sucrose by inversion.

H. W. Wiley presented a report of the meeting of the International Congress of Chemists.

The secretary was requested to insert in the next edition of the methods of analysis the latest revision of the table of atomic weights reported by the committee of the American Chemical Society.

The report of the abstract committee was made by W. H. Beal.

Resolutions were adopted indorsing the movement toward the establishment of a national standardizing bureau.

OFFICERS OF THE ASSOCIATION.

The officers elected for the ensuing year are as follows: President, L. L. Van Slyke, Geneva, N. Y.; vice-president, H. J. Wheeler, Kingston, R. I.; secretary, H. W. Wiley, Washington, D. C.; additional members of executive committee, W. R. Perkins, Agricultural College, Miss., and F. W. Traphagen, Bozeman, Mont.

The referees as announced are as follows:

Phosphoric acid: Referee, H. K. Miller, Lake City, Fla.; associate referee, C. H. Jones, Burlington, Vt.

Nitrogen: Referee, W. R. Perkins, Agricultural College, Miss.; associate referee, F. W. Morse, Durham, N. H.

Potash: Referee, C. L. Hare, Auburn, Ala.; associate referee, L. S. Munson, Washington, D. C.

Soils: Referee, M. E. Jaffa, Berkeley, Cal.; associate referee, F. P. Veitch, Washington, D. C.

Ash: Referee, G. S. Fraps, Raleigh, N. C.; associate referee, E. W. Magruder, Richmond, Va.

Dairy products: Referee, J. A. LeClerc, Geneva, N. Y.; associate referee, G. W. Cavanaugh, Ithaca, N. Y.

Foods and feeding stuffs: Referee, W. H. Krug, Washington, D. C.; associate referee, C. A. Browne, jr., State College, Pa.

Liquors and food adulteration: Referee, W. D. Bigelow, Washington, D. C. (meat and fish, fermented and distilled liquors); associate referees, A. McGill, Ottawa, Canada (cereal products); P. T. Aschmann, Pittsburgh, Pa. (infant and invalid foods—carbohydrate); L. M. Tolman and L. S. Munson, Washington, D. C. (fats and oils, fruit preparations, coloring matters, canned vegetables); A. E. Leach, Boston, Mass. (confections and saccharine products); A. L. Winton, New Haven, Conn. (spices and condiments, baking powders, and baking-powder chemicals); W. Frear, State College, Pa. (vinegar); A. S. Mitchell, Milwaukee, Wis. (flavoring extracts); W. M. Allen, Raleigh, N. C. (preservatives).

Sugar: Referee, E. E. Ewell, Washington, D. C.; associate referee, G. L. Spencer, Washington, D. C.

Tannin: Referee, W. K. Alsop, New York, N. Y.; associate referee, W. H. Teas, Ridgway, Pa.

Fungicides and insecticides: Referee, L. A. Voorhees, New Brunswick, N. J.; associate referee, J. K. Haywood, Washington, D. C.

The committees will remain the same as last year (E. S. R., 11, p. 210).

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

Comparative methods of determining nitrogen in nitrates, L. von Wissell (*Jour. Landw., 48 (1900), No. 2, pp. 105–115, fig. 1*).—Comparative tests of the following methods are reported: (1) The Möckern method[1] (reduction in alkaline solution with zinc and iron powder), (2) the Ulsch method,[2] (3) the Devarda method (reduction in alkaline alcoholic solution with ammonium-copper-zinc alloy—E. S. R., 4, p. 676), and (4) Förster's modification of the Kjeldahl method, using sulphuric acid containing salicylic acid. The Devarda method gave in all respects the most satisfactory results. Of the other three methods the Ulsch and the Förster methods gave equally good results, while the results by the Möckern method were too low. The author considers the Devarda method the quickest and most convenient of the methods tested.

The determination of perchlorates in potassium and sodium nitrates, N. Blattner and J. Brasseur (*Chem. Ztg., 24 (1900), No. 72, p. 767; abs. in Chem. Centbl., 1900, II, No. 14, pp. 780, 781*).—The authors' method (E. S. R., 10, p. 410) is modified as follows: Heat 5 gm. of the dried and finely powdered nitrate with 7 to 8 gm. of pure calcium hydrate (5 gm. of water and 100 gm. of caustic lime) in a platinum or porcelain crucible for 15 minutes over a Bunsen flame, cool and wash into a 125 cc. flask, and allow to stand for 1 hour for the complete diffusion of the soluble salts. Fill to the mark, allowing 3 cc. for the volume of the undissolved lime, shake and filter, neutralize 100 cc. of the filtered solution with dilute nitric acid, using methyl orange as an indicator, and titrate according to Mohr with potassium chromate and decinormal silver solution.

Method of determining chlorid, chlorate, and perchlorate in the presence of each other, N. Blattner and J. Brasseur (*Chem. Ztg., 24 (1900), p. 793; abs. in Chem. Centbl., 1900, II, No. 15, p. 820*).—The method is as follows: Dissolve 20 to 40 gm. substance in 200 cc. of water. Determine chlorin in 50 cc. of this solution by titration with decinormal silver solution. Conduct sulphurous acid through another 50 cc. of the solution or add 50 cc. of a saturated solution of

[1] Landw. Vers. Stat., 1892, p. 165.
[2] Ztschr. Analyt. Chem., 1891, p. 175.

sulphurous acid and boil gently to drive off excess of SO_2. This treatment reduces the chlorate to chlorid. Neutralize with pure calcium carbonate and titrate for chlorin. The perchlorate is determined by the method described above.

Experiments in the determination of cell-wall material, hemicelluloses, and cellulose in plants, A. KLEIBER (*Landw. Vers. Stat., 54 (1900), No. 3-4, pp. 161-213*).—The author reports a comparative study of the Henneberg (Weende), Lange (E. S. R., 8, p. 741), Hoffmeister (E. S. R., 10, p. 606), and Schulze (E. S. R., 8, p. 741) methods of determining crude fiber, on a variety of coarse fodders, palm cake, etc. Concordant results could not be obtained by the Lange method, duplicates differing by as much as 60 per cent. The author agrees with Suringar and Tollens (E. S. R., 8, p. 742) that the cellulose is attacked to a considerable degree in this method. Both the Hoffmeister and Schulze methods, which are similar in that potasium chlorate is employed, gave crude fiber containing too much protein. The results by the Schulze method were, however, more concordant than by the Hoffmeister method. The author modified these 2 methods by boiling for 2 hours with 1.25 per cent sulphuric acid, obtaining materially lower results, indicating that the crude fiber as determined by the original methods contains considerable quantities of material easily soluble in dilute acids (hemicelluloses). The results with this modification were almost invariably concordant. The author believes that if the Hoffmeister or Schulze methods are to be used at all they should be used with the modification proposed, although he does not claim that the method is free from objection, as the cellulose obtained may not be true cellulose and may contain oxycellulose.

An attempt was made to determine the total amount of cell-wall constituents in plants by treating 3 gm. of air-dry substance with 200 cc. of 0.15 per cent potash solution for 2 to 3 days, collecting on a dried and weighed filter, washing with cold and warm water, with cold and hot alcohol, and finally with ether, and then drying to constant weight. The ash and protein were determined and deducted. This method and the use of alkali solution made by dissolving 5 gm. of potassium hydrate in 1 liter of water gave practically the same results. The end product by both methods contained quite large amounts of protein. In the case of substances rich in starch the material was treated with malt extract. The results of these determinations as given by the author are not considered altogether reliable, being possibly too high in some cases and in others too low. The results were considerably higher than those for crude fiber in the same materials.

Experiments were also made in the determination of hemicelluloses by treating the cell-wall material, as obtained above, with 1.25 per cent sulphuric acid, but the question as to how long the treatment

should be continued, the difference in time required by different materials, and other details prevented obtaining reliable results. In all cases the treatment with 1.25 per cent sulphuric acid dissolved considerable amounts of the nitrogen-free cell-wall constituents.

The relation of the reducing power of normal urines to the amount of certain nitrogen compounds present, J. H. LONG (*Jour. Amer. Chem. Soc., 22 (1900), No. 6, pp. 309–327*). The nature of the reducing bodies, behavior of uric acid with copper solutions, the determination of creatinin, uric acid, urea and ammonia, and the ratio of urea to uric acid are discussed on the basis of the investigations reported. While it is not considered possible to draw any exact generalizations regarding the relation between the character of the food and the results obtained, "the urines showing the highest reduction ratio for uric acid and creatinin, as compared with the total reduction, were from men with the strongest physique with a diet containing much meat. On the other hand, the lowest uric acid and creatinin reductions correspond to cases of slighter physique and lower nutrition. . . . But from most of the urines no characteristic relation is apparent."

The nucleic acid of the embryo of wheat and its protein compounds, T. B. OSBORNE and G. F. CAMPBELL (*Connecticut State Sta. Rpt. 1899, pt. 3, pp. 305–339; Jour. Amer. Chem. Soc., 22 (1900), No. 7, pp. 379–413*). The authors used for their investigations a quantity of wheat germ meal from which the bran and endosperm had been very thoroughly removed. By methods which they describe in detail they found that the embryo of the wheat kernel contains the following substances:

(1) A nucleic acid, in considerable quantity, which is not identical with any nucleic acid heretofore described.

"This acid is insoluble in water, forms soluble as well as insoluble compounds with proteid substances, and on hydrolysis yields guanin, adenin, phosphoric acid, and other products not yet identified."

(2) Leucosin and an albumin (constituting about 10 per cent of the embryo), formerly found by the writers in small quantities in the whole kernel of wheat, rye, and barley, and abundantly in malt.

"By saturating extracts of the kernel or of the embryo with sodium chlorid, the leucosin is largely precipitated, from the former as a substance readily soluble again in water, from the latter as an insoluble compound containing about 30 per cent of nucleic acid. From the latter precipitate, dilute salt solution extracts a small amount of nearly phosphorus-free proteid, which behaves like a globulin, being precipitated by dilution or by dialysis, but having essentially the same ultimate composition as leucosin. By dialyzing the aqueous extract in water, nearly all the leucosin contained in it is precipitated, not like a globulin, but as an insoluble compound containing about 20 per cent of nucleic acid."

(3) A globulin, precipitated in spheroids by dialysis and by dilution as a coherent deposit. The yield was about 5 per cent of the embryo.

"Our preparations of this globulin contained from 6 to 17 per cent of nucleic acid, most of them from 12 to 15 per cent. From this the proteid could not be separated by fractional precipitation. . . .

"In composition and properties this globulin agrees with that found by the writer in the kernels of wheat, rye, and barley. So far as we have been able to observe, it differs from edestin, the crystalline globulin obtained from seeds of hemp, flax, and squash only in containing two-thirds as much sulphur."

(4) Two proteoses, together constituting about 5 per cent of the embryo.

"About one-third of the total nitrogen of the embryo is not extracted by water and salt solutions and appears to belong to insoluble compounds. This nitrogen is accompanied by phosphorus corresponding to about 6.75 per cent of nucleic acid, which would contain two-thirds of this insoluble nitrogen. It seems probable, therefore, that this insoluble nitrogen belongs largely to insoluble compounds of nucleic acid and protein. . . .

"The proteids of the embryo differ from those of the dormant endosperm, of this as well as of other seeds, in the facility with which they undergo changes. These changes are the result of a redistribution of acids among the protein and other basic molecules, so that compounds form in the extracts of the embryo which contain various proportions of nucleic acid according to the changing conditions.

"The writer has shown that the globulin, edestin, forms crystalline compounds with one and with two molecules of acid and also compounds with a greater number of acid molecules. There is reason to believe that all other native protein substances form similar compounds; in other words, that proteins are distinctly polyacid bases and that the acid characters which proteids display are due to acids united to their protein molecules, probably in the same manner as in the salts of the purin bases.

"These nucleic acid compounds of the protein constituents of the wheat embryo appear to be compounds of this order. According to this view, no special distinction can be made between nucleins and nucleoproteids, the former being simply compounds containing a greater number of molecules of nucleic acid united to one molecule of protein.

"That the wheat embryo in fact contained the same nucleic acid compounds as we have obtained from the extracts is highly improbable. All that we can conclude is that the embryo contains the different protein substances described, together with nucleic acid, and that these may unite to form a number of different compounds according to the conditions which prevail at any given time."

The proteids of the egg yolk, T. B. Osborne and G. F. Campbell (*Connecticut State Sta. Rpt. 1899, pt. 3, pp. 339-348; Jour. Amer. Chem. Soc., 22 (1900), No. 7, pp. 413-422*).—The authors found that sodium chlorid solutions dissolve from egg yolk a large amount of protein matter resembling a globulin, but which is believed to be a mixture of compounds of protein matter with lecithin.

"Preparations of these compounds contain from 15 to 30 per cent of lecithin. The more soluble products obtained by fractional precipitation contain larger proportions of lecithin than the less soluble—that is, they are more acid compounds. These compounds might well be called lecithin-nucleo-vitellin.

"The lecithin thus combined is not removed by ether, but readily by alcohol. The insoluble lecithin-free proteid, obtained by treating the lecithin compounds with alcohol, has a constant composition when obtained from successive fractional precipitations of the lecithin compound. . . .

"This substance on digesting with pepsin yields paranuclein of variable composition. When the analyses of the nucleovitellin and the paranuclein are calculated

free from phosphoric acid H_3PO_4, possibly identical with 'paranucleic acid,' the composition found for the organic part of all of these preparations is so nearly the same as to show that the proteid and the nuclein are both compounds of one and the same proteid body, vitellin, with a phosphoric acid, possibly H_3PO_4, $H_8P_2O_9$, or some very simple organo-phosphoric acid."

The protein constituents of egg white, T. B. OSBORNE and G. F. CAMPBELL (*Connecticut State Sta. Rpt. 1899, pt. 3, pp. 348–375; Jour. Amer. Chem. Soc., 22 (1900), No. 7, pp. 422–450*).—In a previous paper (E. S. R., 11, p. 309) the author stated that with the substance commonly called ovalbumin there is associated one or more other proteid bodies, the properties of which were not definitely ascertained. The present investigation, which was on a larger scale, confirms this conclusion and presents much additional information respecting these other proteid bodies.

In addition to ovalbumin the authors find in egg white ovomucin, conalbumin, and ovomucoid. The properties and composition of each of these bodies are described at length. Ovalbumin is the chief constituent of egg white, constituting over 50 per cent. Ovomucin is a glycoproteid and constitutes about 7 per cent of the proteid matter of egg white. Conalbumin is obtained from the fractions from which the proteids of egg white are obtained after separating the crystalized fractions. It is separated by heating to 65° and is designated conalbumin "on account of its close relation in properties and composition to ovalbumin. What this relation may be, we have not determined. Conalbumin and ovalbumin may be different compounds of the same protein, or the former may be a derivative of the latter involving a molecular change." Ovomucoid, a glycoproteid, is obtained after all the proteids coagulable by heat have been separated, being precipitated by ammonium sulphate solution. The composition of these proteids is shown in the following table:

Composition of ovomucin, ovalbumin, conalbumin, and ovomucoid.

	Carbon.	Hydrogen.	Nitrogen.	Sulphur.	Phosphorus.	Oxygen.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Ovomucin	50.69	6.71	14.49	2.28	....	25.83
Do	50.95	6.85	14.82	1.94	....	25.44
Ovalbumin (average of 6 preparations)	52.75	7.10	15.51	1.62	0.122	22.898
Conalbumin (average of 3 preparations)	52.25	6.99	16.11	1.70	....	22.95
Ovomucoid	49.02	6.45	12.71	2.38	....	29.44
Do	48.90	6.61	12.16	2.34	....	29.99

The purest preparations of ovalbumin, having a constant specific rotation and the same composition and temperature of coagulation, all gave solutions when boiled with acids which yielded considerable quantities of crystalline precipitates with phenylhydrazin. The amount of osozone actually obtained corresponds to from 2 to 2.5 per cent of carbohydrate calculated as glucose. The authors discuss the

origin of this carbohydrate material, concluding that it "does not originate in admixed ovomucoid, but is derived from the substance constituting the crystallized ovalbumin."

"We have stated our belief that crystallized ovalbumin is a compound of some acid with protein substance and consider it quite probable that this acid contains the carbohydrate group.

"We have been unable to obtain any evidence of carbohydrate in edestin, the crystallized globulin of hemp seed, nor, according to Hammarsten, can a carbohydrate be split from casein, vitellin, myosin, and fibrinogen. This subject requires further careful study before a definite conclusion can be reached. At present the preponderance of evidence indicates that the carbohydrate is not derived from the protein molecule, but from substances combined with the protein as it is obtained from the tissues or secretions."

On the chemical properties of the fat in Norwegian creamery butter, F. H. Werenskiold (*Aarsber. Offent. Foranst. Landbr. Fremme, 1899, pp, 117–127*).—Samples of butter churned in 9 Norwegian creameries were taken at regular intervals by authorized agents under conditions that precluded chances for adulteration, 254 samples being taken during 1899. The following data show the extremes obtained during the year:

Specific gravity (at boiling point of water)	0.8636–0.8678
Specific gravity (at 100° F.)	.9082–.9130
Refractive index (at 45° C.)	39.0–43.7
Volatile acids (Reichert-Wollny number)	21.2–34.7

The variations obtained are believed to be too narrow for Norwegian butter. The author finds that poor nutrition, exposure to cold, and differences in the system of feeding practiced in summer and in winter are the chief causes of the variations in composition. A higher specific gravity and content of volatile acids and a lower refractive index were obtained in winter than in summer in the case of all creameries. As a general rule cold weather occurring when the cows were on pasture depressed the specific gravity and the Reichert number and increased the refractive index.—F. W. WOLL.

A systematic handbook of volumetric analysis, F. Sutton (*London: J. & A. Churchill, 1900, pp. XI+640, figs. 116*).—The eighth edition of this well-known treatise, revised and enlarged. "A considerable number of additions and alterations have been made to methods given in former editions, and several substances not previously treated have been introduced."

The determination of nitrogen in nitrate of soda, O. Böttcher (*Jour. Landw., 48 (1900), No. 3, pp. 287–289*).—A reply to a criticism by L. von Wissell (see p. 510) of the method proposed by the author (the so-called Möckern method).

A reply to the above remarks, L. von Wissell (*Jour. Landw., 48 (1900), No. 3, pp. 291, 292*).

Note on the determination of nitric nitrogen by Schloesing's method, C. Davidson (*Chem. News, 81 (1900), No. 2101, pp. 97, 98, fig. 1*).

A modification of Péligot's absorption apparatus for ammonia determinations, F. Pannertz (*Ztschr. Analyt. Chem., 39 (1900), No. 5, pp. 318–320, fig. 1*).—The lower U-tube of the Péligot apparatus is so arranged as to prevent regurgitation of the liquid in the absorption bulb.—C. B. WILLIAMS.

Preparation of sodium cobaltinitrite and its application for the detection of potassium, E. Bilmann (*Ztschr. Analyt. Chem., 39 (1900), No. 5, pp. 284–289*).—The author claims that this reagent is more sensitive than platinum chlorid and far less expensive.—C. B. WILLIAMS.

The estimation of formic acid in the presence of acetic acid, F. Sparre (*Ztschr. Analyt. Chem., 39 (1900), No. 2, pp. 105, 106*).—The author strongly recommends the method of Portes and Ruyssen, but thinks they intended to instruct the employment of a 1 per cent solution of the substance instead of a 10 per cent, as the amount of mercuric chlorid indicated to be used is not sufficient for a 10 per cent solution.—C. B. WILLIAMS.

Refractometric butter analysis, A. Partheil and J. von Velsen (*Arch. Pharm., 238 (1900), pp. 261–279; abs. in Jour. Chem. Soc. [London], 78 (1900), No. 455, II, p. 633*).

On the determination of the iodin value, J. J. A. Wijs (*Analyst, 25 (1900), Feb., pp. 31–35*).

Detection of cane sugar in milk sugar, J. Landin (*Chem. Ztg., 24 (1900), No. 21, p. 211*).

Methods of sugar analysis of the laboratories of the French Ministry of Finance, E. Mascart (*Ztschr. Ver. Deut. Zuckerind., 1900, No. 537, II, pp. 937–939*).

The quantitative determination of volatile oils in spices, K. Mann (*Chem. Ztg., 24 (1900), No. 13, p. 124*).

Determination of tannins, L. Specht and F. Lorenz (*Chem. Ztg., 24 (1900), No. 17, pp. 170, 171, fig. 1*).

Nut oils, L. H. Merrill (*Maine Sta. Bul. 65, pp. 108–111*).—The author reports determinations of the refractive index, specific gravity, iodin absorption number, and the calories per gram of oils of the following nuts: Beechnut, Brazil nut, butternut, filbert, hickory, pecan, pistachio, pine nut, walnut, peanut (raw and roasted), and cocoanut. The method of analysis is given and the properties of nut oils are briefly discussed.

Limestones, petroleum, etc., A. M. Peter and H. E. Curtis (*Kentucky Sta. Rpt. 1898, pp. XXII, XXIII*).—Analyses of 6 samples of limestone, 2 of petroleum, and 1 of an unidentified mineral are reported.

The wide occurrence of indicators in nature, G. S. Fraps (*Amer. Chem. Jour., 24, (1900), No. 3, pp. 271–276*).—"Some 74 kinds of colored flowers, both wild and cultivated, the leaves of 5 varieties of coleus, the cowpea bean, the blackberry, mulberry, smilax berry, strawberry, and the red beet were extracted with water or dilute alcohol and the extract tested for indicators." The results show that nearly all of the extracts possessed indicator properties, and some were quite sensitive. The materials are grouped in 4 classes as regards their behavior with acids and alkalis.

A burette for accurate gas analysis, A. H. White (*Jour. Amer. Chem. Soc., 22 (1900), No. 6, pp. 343–349, figs. 5*).

A convenient micro-polariscope for food examination, A. L. Winton (*Reprinted from Jour. Appl. Micros., 2 (1899), No. 10, pp. 550, 551, figs. 2*).—This instrument and its use are briefly described.

A simple thermoregulator, F. Bolm (*Ztschr. Analyt. Chem., 39 (1900), No. 5, pp. 315–317, figs. 2*).—The efficiency of the regulator depends very much upon the construction of the bath. Asbestos-lined, water, or oil baths are recommended by the author.—C. B. WILLIAMS.

BOTANY.

A study of the root systems of cultivated plants grown as farm crops, A. M. Ten Eyck (*North Dakota Sta. Bul. 43, pp. 535–550, figs. 12*).—In a previous publication (E. S. R., 11, p. 215) a prelimi-

nary report is given on the root systems of wheat, oats, and corn, with some discussion of the root systems of other crops. The present bulletin is devoted to investigations in the same line conducted in 1899, and includes a brief review of the study of the roots of wheat, oats, and corn, and of the manner in which the root samples were prepared.

A further investigation of the root system of flax showed that flax possesses a very intricate system of rooting, and while the roots are not as long, they more completely occupy the upper layers of the soil than the roots of wheat or oats. The roots of field peas were investigated on plants 86 days after planting. The vines at this time were $5\frac{1}{2}$ ft. long, while the roots reached only to a depth of 3 ft. and were rather sparingly supplied with branches and fibers. Like the roots of the flax, the bulk of the fibrous roots lie within 8 or 10 in. of the surface, showing that in practice peas do not require a deep soil.

The roots of 1 and 2 year-old plants of *Bromus inermis* were examined. At 1 year old the roots had attained a depth of over 4 ft. and formed a good sod. The roots of the 2-year-old grass were traced to a depth of $5\frac{1}{2}$ ft., and the author believes they probably went a foot deeper. Comparisons were drawn between the root systems of native prairie grasses, timothy roots, and the roots of *Bromus inermis*, showing that the native prairie grasses do not make as heavy a sod as the cultivated ones, the prairie-grass roots in the sample examined reaching less than 3 ft. in depth.

In the previous investigation the specimens of potato roots were considered unreliable on account of the plants having been injured by frost. In the investigations here reported, samples were taken of an early and a late variety of potatoes, from which it was seen that the main portion of the root growth is superficial. Forty-three days after planting, the principal part of the root development was found to lie within 8 in. of the surface of the ground. The lateral roots had extended from hill to hill and interlaced. Some of the principal lateral roots were found to be only $2\frac{1}{4}$ in. from the surface at 6 in. from the hill. This root development would indicate the necessity of shallow cultivation of this crop, and this was confirmed in experiments with deep and shallow cultivation, the results showing a decided advantage for the shallow cultivation of potatoes unhilled. The samples of a late variety of potatoes showed that late potatoes root more freely and more deeply than early ones, and as a result will not stand as close planting as the early varieties. When the hills are about 3 ft. apart each way, the soil is very fully occupied by the roots to a depth of 3 ft.

From examination of the roots of sugar beets it was found that this crop does not develop lateral roots near the surface of the ground. The greatest amount of branching and fibrous growth of beet roots takes place in the space between 8 and 14 in. in depth.

The effect of subsoiling on root growth and development of sugar

beets was investigated, with the result that on the subsoiled plats there was a considerably better development of feeding roots, and the main root was more symmetrically developed.

The soils in which the various roots grew are described at some length, and general remarks and conclusions similar to those in the previous bulletins are given.

Sugar-producing plants, L. GESCHWIND (*Ann. Agron.*, *26* (*1900*), *No. 8*, *pp. 383-409*).—The author has given a brief report on the present state of information relative to sugar producing plants, dividing them into the following categories: (1) Those which have been shown experimentally to contain sugar, but whose utilization in an industrial manner has not been attempted; (2) those plants used in producing sugar, but which are more or less local in their use; and (3) those which furnish the greater portion of the sugar of commerce. In the first category are mentioned carrots, melons, cucumbers, gourds, agaves, etc. In the second class are described various species of palms, maize, sorghum, and sugar maple, while in the third are described sugar cane and sugar beets.

Hydrocyanic acid in plants, M. SOAVE (*Nuov. Giorn. Bot. Ital.*, *6* (*1899*), *pp. 219-238*; *abs. in Jour. Roy. Micros. Soc.* [*London*], *1900*, *No. 3*, *p. 343*).—From a series of experiments upon the bitter almond and *Pangium edule* it is concluded that cyanogen compounds in plants are transitional substances from which are obtained nitrogenous food materials by the plants. From the time the seeds begin to swell, so long as the embryo is dormant, the bitter almond contains no trace of hydrocyanic acid. It makes its appearance only when the seed begins to germinate and then only in the stem, none being observed either in the root or the cotyledons. Sweet almonds are said to contain no trace of amygdalin.

Soil inoculation for promoting the growth of legumes, F. T. SHUTT (*Canada Expt. Farms Rpts. 1899*, *pp. 150, 151*, *pl. 1*).—A report is given of the use of Nitragin, in which a second year's growth of clover which had been inoculated is compared with similar plats without treatment. While in the first year's crop the difference was slight, the second year's growth on the inoculated plats was more than 3 times that of the untreated. The author states that the results of his 3 years' investigations indicate the possibility of obtaining a good crop of clover on very poor soil with the aid of Nitragin, provided the soil is drained, the season favorable, and there is present a sufficient supply of mineral plant food. Certain difficulties to the introduction of Nitragin are mentioned, among them the difficulty of obtaining the cultures and the necessity of protecting from strong light and keeping at a low temperature. It is suggested that it is possible to obtain the same results by taking soil from fields that have grown good crops of clover and sowing over poor soil.

Twigs of common trees and shrubs, F. H. HILLMAN (*Nevada Sta. Bul. 45, pp. 16, figs. 18*).—This bulletin is the first of a proposed series of studies in plant life, and describes the twigs and buds of poplars, elms, maples, and willows.

Notes on some Andropogons in Jamaica, W. HARRIS (*Bul. Bot. Dept. Jamaica, n. ser., 7 (1900), No. 10, pp. 152–154*).—Notes are given on some of the economic uses of *Andropogon squarrosus*, *A. schoenanthus*, and *A. nardus*.

Influence of copper salts on plants, E. CHUARD and F. PORCHET (*Bul. Soc. Vaud. Sci. Nat., 4. ser., 36 (1900), No. 135, pp. 71–77*).—Experiments made by the authors tend to show that the favorable effects of compounds of copper on the growth and fertility of plants have been exaggerated. The increase in the amount of sugar in the fruit of grapes and gooseberries sprayed with Bordeaux mixture is said not to exceed 1 or 2 per cent. Copper was not found present in the leaves. The deeper color of the leaves, they claim, is not due to an increase in the amount of chlorophyll.

The effect of carbon dioxid upon water transportation in plants, P. KOSAROFF (*Bot. Centbl., 83 (1900), No. 5, pp. 138–144*).—A series of experiments is reported with water cultures of *Phaseolus vulgaris*, leafless stem of Eupatorium, leaf of Acer, and twigs of Sparmania, *Morus alba*, and *Prunus cerasus*, in which the effect of carbon dioxid on water transportation was shown. Carbon dioxid solutions greatly check the ability of plants placed in the solution to take up water. This was found to be true for herbaceous and woody plants. It proved injurious to all living tissues with which it came in contact. The wilting of plants subjected to a continued exposure to carbon dioxid is attributed to the reduction of transpiration.

The electrical effects of light upon green leaves, A. D. WALLER (*Science, n. ser., 12 (1900), No. 297, pp. 377, 378*).—A brief abstract is given of the paper in which appears the result of the author's investigation upon the action of light upon green leaves, being accompanied by electrical effects. Young leaves were placed upon a glass plate and connected with a galvanometer, one portion being shaded and the other exposed to the light. The deflection of the galvanometer during the illumination was sufficient to indicate an electric current in the leaf from the excited to the protected part. The amount of current in some cases was measured, and the effect of various gases, as shown upon the electric current, is given.

The influence of temperature on protein metabolism, D. PRIANISHNIKOV (*Ber. Deut. Bot. Gesell., 18 (1900), No. 6, pp. 285–291*).—Experiments with pea seedlings showed that the energy of protein metabolism increases with the increase in temperature up to at least 37° C.

Formation of resin in plants, A. TSCHIRCH (*Festsch. Schwendener, Berlin, 1899, pp. 464–470; abs. in Jour. Roy. Micros. Soc. [London], 1900, No. 2, p. 214*).—The mode of formation of oil cells in *Cinnamomum cassia* is described in detail. They are said to be developed from small cells filled with protoplasm by the gradual suberation of the cell walls, accompanied by the formation of a layer of mucilage. Later the inner strata of the mucilage layer are absorbed and the protoplasm fuses with the remainder of the mucilage, the resin-bearing layer resulting from their union. Small drops of oil are formed which gradually pass into the cavity and the resin-bearing layer is ultimately almost entirely resorbed. Similar phenomena are said to occur in other resin-bearing plants.

On artificially changing the coloring of flowers, M. MIYOSHI (*Bot. Centbl., 83 (1900), No. 11, pp. 345, 346*).—A brief account is given of experiments with alum, hydrochloric acid, and caustic potash in changing the coloring of flowers. Watery extracts were made of various red, purple, and lilac colored flowers and dilute solutions of the chemicals mentioned added. The alum changed the lilac to blue and the rose color to lilac. Hydrochloric acid changed the lilac and the light red to a copper red, and in some cases the lilac was changed to green or brown. Potash transformed the rose and lilac to green or yellow. Similar results were obtained when cut flowers were placed in solutions of the above, or by watering with them

plants grown in pots. The experiments were conducted with Hydrangea, *Calistephus chinensis*, *Campanula alliariifolia*, and *Licolis radiata*.

The limit of concentration of nutrient solutions for fungi, T. Bokorny (*Allg. Brau. u. Hopfen Ztg., 1900, No. 51, p. 553*).

A classification of the fleshy Pezizineæ, E. J. Durand (*Bul. Torrey Bot. Club., 27 (1900), No. 9, pp. 463–495, pls. 6*).

METEOROLOGY.

How to prevent hailstorms, P. N. Kritski (*Trudi Imp. Voln. Ekon. Obsh., 1899, No. 2, pp. 193–205*).—The cause of hailstorms being, according to the author, the accumulation of electric energy in the clouds, he proposes to diminish this accumulation and thus probably entirely prevent hailstorms by means of a kite similar to that used by Franklin in his famous experiments. The kite is to be made of a rectangular piece of light fabric stretched over a wooden frame. For a wind with a velocity less than 7 meters per second kites about 4 meters in length and 2.6 in width are recommended; for a wind with a greater velocity than 7 meters per second 3.2 by 2.1 meters are suitable. The tail consists of a cord 3 mm. in thickness to which 3 cones are consecutively attached. The first cone has a diameter of 450 mm. and is situated 10 meters from the kite, the second 300 mm. in diameter is situated 4 meters from the first, and the third of the same diameter is situated 3 meters from the second. To the kite are attached 4 copper rods each 350 mm. long and 4.5 mm. in diameter. The rods each terminate in a point either made of platinum or plated with the latter and are in metallic contact with the wire (or rope) to which the kite is attached. The other end of this wire may be in contact with the earth, or with some device for storing and utilizing the electricity drawn from the sky. The kite wire need not be more than 3,500 ft. long (the mean height of the clouds). The kites should be kept flying until the danger of the hailstorm has passed.—P. FIREMAN.

Monthly Weather Review (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 28 (1900), Nos. 4, pp. 141–191, figs. 4, charts 9; 5, pp. 193–238, figs. 4, charts 8; 6, pp. 239–278, fig. 1, charts 8*).—In addition to the usual reports on forecasts, warnings, weather, and crop conditions, meteorological tables and charts, and lists of recent papers on meteorology, these numbers contain the following articles and notes:

No. 4, special contributions on Special report on the floods in the Colorado Valley, Texas, April 7 to 17, 1900, and other floods during the same period (illus.), by I. M. Cline; The drought of 1899 in southwest Missouri, by J. S. Hazen; The climatology of Habana, Cuba, by E. del Monte; Phenological observations on the Potomac, by F. W. Very; and notes by the editor on death of Mr. Cyrus Ellenberger, storm waves not tidal waves, an ice storm, storm in Yucatan, local anemometric peculiarities, the seasonable rain in Colorado, freshets in James River, Virginia, phenology in Ohio, hail and its methods of formation, studies in raindrops, the formation of large raindrops, photography in meteorology, a new meteorological journal, the effects of

diminished pressure on cooking, sudden temperature changes in Montana (illus.), weather forecast cards by rural delivery, ice and navigation at St. Michael, Alaska, Oregon weather and Bering Sea ice, the Brooklyn museum of meteorology, lectures on meteorology, meteorology in the universities, the Weather Bureau and the universities, the climatology of California, and isotherms for a given altitude.

No. 5, special contributions on Special report on the floods in the Brazos River Valley, Texas, April 27 to May 17, 1900; also freshets in other streams (illus.), by I. M. Cline; Oregon weather and Bering Sea ice, by E. A. Beals; Local storm at Springfield, Mo., by J. S. Hazen; Prof. P. E. Doudna, by F. Cajori; Halo at Detroit, Mich., May, 1900 (illus.), by J. K. Hooper; Lake levels and wind phenomena (illus.), by A. J. Henry; and notes by the editor on rainfall in Jamaica for 1899, Oregon weather and Bering Sea ice, seasonal forecasts in Colorado, the thunderstorm of May 16 in Idaho, the Hawaiian standard of time, heavy rainfall in local storms, the June rise of the Missouri and Mississippi rivers, a meteorological library, monument to Cantoni, lectures on meteorology, the drift of the Gulf stream near Key West, Fla., eclipse shadow bands and correlated atmospheric phenomena, storm warnings on the Oregon coast, index to the monthly reports of the California section, and Cape Nome temperatures.

No. 6, special contributions on Extension of Weather Bureau work, by E. B. Garriott; Rainfall and drainage in the Upper Chagres River, by H. L. Abbot; Cloudburst at Erwin, Tenn., by S. G. Worth; The seismograph at the observatory at Carson City, Nev. (illus.), by C. W. Friend; Droughts, famines, and forecasts in India, by E. D. Archibald; and notes by the editor on meteorological cablegrams, a local weather sign, climatology in California, meteorological conditions favorable to spontaneous combustion, Weather Bureau service in Haiti, the laws of atmospheric circulation, prevention of hail by cannonading, the Weather Bureau in Dominica, W. I,, the Nile floods and the Indian monsoons, another use for the kite, a new meteorological journal, weather cablegrams from the Azores, and pineapple growing in southern Florida.

Meteorological summary for 1898, V. E. Muncy (*Kentucky Sta. Rpt. 1898, pp. XXXVII–XXXIX*).—Tabular monthly summaries are given of observations at Lexington, Ky., on atmospheric pressure, temperature, precipitation, cloudiness, and wind. The mean barometric pressure for the year was 29.01 in., the highest 29.66, lowest 28.29; mean temperature 64.40° F.; the highest 96, July 2; lowest —1, December 14; total annual precipitation 60.52 in.

Meteorological observations, W. T. Ellis et al. (*Canada Expt. Farms Rpts. 1899, pp. 41, 42, 227–229, 258, 335, 388, 425*).—Summaries are given of observations during 1899 on temperature, precipitation (rainfall and snow fall), and sunshine at Ottawa; Nappan, Nova Scotia; Brandon, Manitoba; Indian Head, Northwest Territories; and Agassiz, British Columbia.

Meteorological conditions of the cultural year 1898–99, P. de Caluwe (*Exposé Cult. Exper. Jard. Gand, 1898–99, pp. 1–5*).—A summary of observations, mainly on temperature and precipitation, during the year ended October 31, 1899.

Normal distribution of rainfall in the Madras Presidency, C. Benson (*An account of the normal distribution of the rainfall in the Madras Presidency based on the records of twenty-five years. Madras: Printed by the Superintendent, Government Press, 1899, pp. 20, charts 10*).—This is a report of the deputy director of the Department of Land Records and Agriculture. The rainfall conditions are charted and discussed with the following arbitrary divisions of the year: (1) The hot weather, April and May; (2) the southwest monsoon, June to September; (3) the northeast monsoon, October to December, and (4) the dry weather, January to March.

Storms and hail during the years 1897 and 1898 in Steiermark, Kärnten, and Ober-Krain, K. Prohaska (*Mitt. Naturw. Ver. Steiermark, 1897, No. 34, pp.*

141-176; 1898, No. 35, pp. 141-169).—These reports record observations on lightning strokes, thunderstorms, hailstorms, etc.

The influence of forests on climate, J. SCHUBERT (*Wetter, 17* (*1900*), *p. 209*).

On the influence of forests on the temperature of the air, MUTTRICH (*Meteor. Ztschr.* [*Vienna*], *17* (*1900*), *p. 356*).

The climate of Sweden according to Ekholm, ENGEL (*Geographie, 1900, p. 199*).

The Manila observatory, J. ALGUÉ (*Nat. Geogr. Mag., 11* (*1900*), *No. 11, pp. 427-438, figs. 2*).—An account of the history and work of this institution for meteorological inquiries.

AIR—WATER—SOILS.

Field operations of the Division of Soils, 1899, M. WHITNEY ET AL. (*U. S. Dept. Agr., Rpt. 64, pp. 198, pls. 29, figs. 19, col. maps 11*).—This is a report of progress by the Division of Soils in surveying, investigating, and mapping the soils of the United States. It contains the following papers: (1) A review of the operations of the year by the Chief of the Division, which summarizes methods used and results obtained; (2) a soil survey of the Pecos Valley, New Mexico, by T. H. Means and F. D. Gardner, which has already been noted (E. S. R., 11, p. 912); (3) a soil survey of Salt Lake Valley, Utah, by F. D. Gardner and John Stewart, which has also been noted elsewhere (E. S. R., 12, p. 317); (4) reconnoissances with reference to topography, soils, and alkali of Sanpete, Cache, and Utah counties, Utah, and Cache a la Poudre Valley, Colorado, by T. H. Means; (5) a soil survey in the Connecticut Valley, by C. W. Dorsey and J. A. Bonsteel, which treats of the climate, topography, geology, soils, and the culture of tobacco in that valley; (6) application of the theory of solutions to the study of soils, by F. K. Cameron; and (7) the method of mechanical analysis as applied to alkali soils and the influence of salts (sodium chlorid, sulphate, and carbonate) upon the rate of evaporation from soils, by L. J. Briggs.

Areas aggregating about 720,000 acres have been studied and mapped (on a scale of 1 in. to the mile). The maps show the areas of the different kinds of soils found in the districts studied, and, for the arid region, the alkali conditions (the distribution and relative intensity of total alkali and of black alkali) and the depth to standing water. The soil survey of the Connecticut Valley forms part of a general plan to investigate and map the tobacco soils of the United States (E. S. R., 10, p. 531).

"The map shows the distribution of the soils of the valley, which are described with all necessary detail in the accompanying report. The sides of the valley are formed for the most part from the glacial deposits of Triassic sandstone, and in the northern part of diabase. The soils of the valley proper are sediments which have been washed over and assorted in the great lake which is supposed to have covered this area in prehistoric times. Some of the soils occur in well-defined terraces, which formed the shores of the old lake, or which were formed subsequently by the river and streams. Over much of the area, however, these terraces are ill-defined or

entirely lacking, and, from the differences in elevation of the same soil formation in different parts of the valley, there are even evidences to disprove the terrace theory of the physiography of the country. Certain it is, however, that the soils were laid down by water, and that in so doing they were sorted out in various grades of fineness. Beginning with the present meadows, which are composed of very fine sand and silt, the Podunk region is in a well-defined terrace elevated about 20 ft. above the meadows and is composed of one grade coarser material, but still so fine as to be just distinguishable by the eye.

"The Hartford loam, forming the principal tobacco soil, in extent at any rate, is a grade coarser than this, while the Windsor loam, believed to be the original bottom of the old lake in its shallowest portion, is very coarse sand containing some gravel. These Windsor sands produce the finest wrapper leaf when the season is favorable, but a good crop is secured only one or two years out of five."

The reconnoissances of the Sanpete, Cache, and Utah counties, Utah and the Cache a la Poudre Valley in Colorado show that the presence of injurious amounts of alkali in the soils of those regions is due to defective drainage, and the introduction of a system of underdrainage by means of tile is recommended.

In the paper on the theory of solutions as applied to the study of soils there are presented:

"(1) An outline of the theory of solutions, showing that a solute by virtue of the presence of the solvent behaves as though it were a gas, and that electrolytes present the added phenomena of electrolytic dissociation or ionization.

"(2) A demonstration that the reactions under investigation are of a reversible type, and in consequence the Mass law is applicable to a study of the equilibria among the solutes.

"(3) An application of these views, showing how the solubilities of the sulphate and carbonate of lime in nature are increased by the presence of a solute which dissociates but yields no common ion.

"(4) An announcement of the presence of sodium carbonate in the waters of the Great Salt Lake, Utah, and an explanation of why this fact has previously escaped observation, based on the relation which obtains between the ionization products and the solution constant. A similar explanation is offered for the scant amount of lime in the waters of this lake.

"(5) An examination of the hypothesis of Hilgard as to the rôle of carbon dioxid in the genesis of alkali, in which it is demonstrated that the phenomena observed are more satisfactorily accounted for in terms of the theory of solution, and that the carbon dioxid must be regarded as a contributing cause, but not a necessary one.

"(6) An examination of the Hilgard method for the reclamation of black alkali soils, with an explanation of the reactions observed and of the importance of the controlling conditions respecting drainage and the accumulation of carbon dioxid, empirically announced by Hilgard.

"(7) An examination of the reaction between calcium sulphate and the carbonates of ammonium. The use of gypsum for conserving ammonia in manure piles is explained. Some errors, with the reasons therefor, which may accompany the use of ammonium carbonate in analytical operations involving salts of the alkaline earths are pointed out.

"(8) A discussion of some analytical problems in a chemical examination of alkali soils. The nature of the problems is made clear. The relative merits of leaching the soils and taking a solution in contact with the soil in preparing the sample are discussed, and the advantages in favor of the latter procedure indicated. The necessity of making a direct estimation of each constituent is demonstrated.

"(9) A plea for the rational statement of analytical data, inasmuch as it is the ions which are determined and not the salts. Furthermore, it is the ions with which we are generally concerned in the study of any particular problem.

"(10) A field method for the estimation of sulphates, chlorids, and carbonates, involving 3 titrations which may all be made on the same sample in one vessel, Its use in reconnoissance work is described.

"(11) A rapid method for the estimation of sodium carbonate in the presence of the bicarbonate, depending on the conversion of the alkaline carbonate to the neutral acid carbonate, with the formation of a neutral sulphate by the addition of acid potassium sulphate. The use of the method in the laboratory and in the field is described, and its probable availability for technical work is suggested. The objections to the use of sulphuric acid in determining 'alkalinity' are made evident.

"(12) Observations on the hydrolysis of sodium carbonate and sodium silicate and the inversion of sodium bicarbonate and sodium bisilicate to the normal salts are described briefly.

"(13) A discussion on the formation of hardpan and similar deposits, in which it is pointed out that the hydrolysis of the salts of weak mineral acids and subsequent desiccation and deposition of the solution products must be taken into account in any hypothesis as to their genesis.

"(14) An explanation of the solution and hydrolysis of certain minerals and the consequent alkalinity they display.

"(15) Suggestions for the study of the functions of fertilizers, in which the importance of considering the solution phenomena which their presence may effect in the ground waters is made evident.

"(16) Some observations on selective absorption and other physico-chemical phenomena which are incidental to a complete study of the properties of a soil."

A paper on methods of mechanical analysis as applied to alkali soils discusses the disintegration of such soils during the progress of analysis due to the solvent action of the water used in making the mechanical separation, and describes apparatus and methods applicable to such soils, attention being called especially to the advantages of the centrifugal method for this purpose. The treatment after ignition of the mechanical separations with carbon dioxid, according to Hilgard and Jaffa, to convert the oxids of the alkaline earths into carbonates, is recommended, and the application of the electrical method (E. S. R., 11, p. 325) to the determination of the water-soluble content of soils in connection with their mechanical analysis is explained.

The conclusions from the investigations on the influence of sodium chlorid, sulphate, and carbonate upon the rate of evaporation of water from soils are summarized as follows:

"(1) Salts influence the evaporation of water from the surface of a soil by changing the surface tension, the viscosity and the vapor pressure of the system, and the physical character of the soil, particularly at the surface.

"(2) The surface tension and viscosity influence the rate of evaporation only through the modification of the rate of capillary movement. Both surface tension and viscosity increase with increase in concentration. An increase in surface tension increases the rate of capillary movement, while increase in viscosity diminishes it. These two factors consequently oppose one another.

"(3) The rate of capillary movement within a soil is of secondary importance to the physical character of the surface, as modified by the presence of crystallized salts.

"(4) The relative rate of evaporation from a soil moistened with pure water and

salt solution, respectively, is the same as for the water and solution without the soil, providing no surface mulch is formed.

"(5) The rate of evaporation gradually decreases with increase in concentration.

"(6) The diminution of evaporation with increasing concentration is much less than the corresponding diminution in vapor pressure. This is due to the fact that the atmosphere is never vapor free, and that the diffusion of water vapor is retarded by the surrounding air.

"(7) The diminution of evaporation of soils containing solutions of 'alkali' salts is much greater than can be accounted for through the influence of the lower vapor pressure, and is due to the formation of a mulch at the surface of the soil through the crystallization of the salts."

A study of the physical properties of clay as related to soil structure, V. H. Davis (*Agr. Student, 7 (1900), No. 1, pp. 15–18*).—This is an abstract of a thesis presented to the faculty of the Ohio State University in 1900. Tests of the tensile strength of wet ground brick and clay from the university campus by a modification of G. E. Ladd's method and of the breaking strength of dry brick of the same material are reported. It was found that the tensile strength of a wet substance having no inherent plasticity, such as the ground brick used in these experiments, was practically independent of the size of the particles. With a substance naturally plastic, like the clay, the tensile strength increases as the size of the particles decreases. A great difference was found in the breaking strength of the wet and dry substances. The conclusion is drawn "that fineness of particles accompanies plasticity and is essential to it, but is not in itself a cause of plasticity, and that the real cause is yet to be determined."

The moisture of the soil under the pine forest of the Khrenov estate, G. Morosov (*Selsk. Khoz. i Lyesov., 196 (1900), Mar., pp. 481–519*).—The forest is situated on dune hills. The moisture was determined at the depths of 10 cm., 25 cm., 50 cm., 1 meter, $1\frac{1}{2}$ meters, and 2 meters. The author's results corroborate those obtained by Visotski, who arrived at the following conclusions: (1) The upper surface of the soil dries out most where it is most open, as, for instance, on black fallow, and least under forest; (2) the soil as a whole dries out most under virgin soil covered with grass, next under forest, and least under black fallow; and (3) the subsoil dries out most under forest, next under virgin soil, and least under black fallow.

In addition the author found that: (1) The subsoil under forests in the spring is more moist than in the open, and only later on does it dry out more than under the latter; (2) the soil is not in all cases more moist under forests than under treeless areas. There are certain sandy soils covered with pines in which the upper layers, except in the early spring, are drier than in treeless areas.—P. FIREMAN.

The air, H. Blücher (*Die Luft. Ihre Zusammensetzung und Untersuchung, ihr Einfluss und ihre Wirkungen, sowie ihre technische Ausnutzung. Leipsic: Otto Wigand, 1900, pp. XII+322, figs. 34*).—This book treats of the constituents and impurities of air, its physical properties, including the meteorological phases of the subject; physical,

chemical, and bacteriological studies of the air, as related to its properties and variations; the influence of the air on organic and mineral substances and on the plant and animal worlds, including weathering, decomposition, respiration, nitrification, assimilation of nitrogen by plants, transmission of plant and animal diseases, etc.; and the technical uses of air in pumps, windmills, etc., and in compressed and liquid form. The book contains name and subject indexes and numerous references to literature.

The carbon dioxid of the atmosphere, E. A. LETTS and R. F. BLAKE (*Sci. Proc. Roy. Dublin Soc., 9 (1900), II, pp. 107–270; abs. in Jour. Chem. Soc.* [*London*], *78 (1900), No. 455, II, p. 622*).

Well waters from farm homesteads, F. T. SHUTT (*Canada Expt. Farms Rpts. 1899, pp. 155–157*).—Analyses of 49 samples of water from different parts of Canada with reference to sanitary condition are reported.

Mineral waters, A. M. PETER and H. E. CURTIS (*Kentucky Sta. Rpt. 1898, pp. XXIII–XXVIII*).—Partial analyses of 19 samples are reported.

A comparative study of the methods used for the measurement of the turbidity of water, G. C. WHIPPLE and D. D. JACKSON (*Tech. Quart., 13 (1900), No. 3, pp. 274–294, figs. 4*).—On the basis of the investigations here reported, the use of the silica standard for the determination of turbidity in water is recommended.

The question of the drying up of rivers in its past and present status, E. OPPOKOV (*Selsk. Khoz. i Lyesov., 197 (1900), June, pp. 633–706*).—On the basis of observations on the Dnieper and Volga the author combats the prevalent opinion that Russian rivers are decreasing in volume. He concludes that the life of rivers and the quantity of water in them depend chiefly on the size of their drainage basins and the quantity and conditions of the precipitation. The influence of a decrease of the area of forests and marshes is only of secondary importance and is commonly greatly exaggerated.—P. FIREMAN.

A normal chlorin map of Long Island, G. C. WHIPPLE and D. D. JACKSON (*Tech. Quart., 13 (1900), No. 2, pp. 145–148*).—This map, based on analyses of 80 samples of water, shows that, except at the eastern end of the island, the normal chlorin is below 6 parts per million of water.

Drainage for alkali spots, C. E. MEAD (*New Mexico Sta. Bul. 33, pp. 39, 40*).—A brief account is given of an attempt to remove the soluble salts from a "chico" or alkali spot by means of open ditches and flooding.

The condensation of water vapor by the soil, E. WOLLNY (*Fühling's Landw. Ztg., 49 (1900), Nos. 19, pp. 700–705; 20, pp. 739–746*).—The author discusses this subject at some length and concludes that the power of soils to condense water vapor from the air is of no practical value, either directly or indirectly.

Lectures on some of the physical properties of soil, R. WARINGTON (*Oxford: Clarendon Press; London: Henry Frowde, 1900, pp. XV+231, figs. 6*).—This book gives the substance of a course of lectures delivered in 1896 by the author as Sibthorpian Professor of Rural Economy in Oxford University. It does not claim to be a textbook dealing exhaustively with the physical properties of soils, but lectures discussing with some fullness particular phases of the subject. "In these lectures the attempt has been made to treat every subject from an experimental point of view, and a considerable space will be found occupied by accounts of the investigations which appear to have thrown most light upon the subjects discussed." Liberal use is made of station literature, especially that published by the American stations, since the English literature on the subject is very limited. Acknowledgment is made of special indebtedness to the work of Hilgard, King, and Whitney. The book contains chapters on the physical constitution of soil, relations of soil to water and to heat, and movements of salts in the soil. It is the intention of the author to follow this work with a treatise on the chemistry of soil on a similar plan.

The action of the wind on the soil, M. STAHL-SCHRÖDER (*Selsk. Khoz. i Lyesov.,*

196 (*1900*), *Feb.*, *pp. 363–378*).—The author discusses the influence of winds on the moisture, temperature, and gas content of the soil; on chemical composition; and as a geological agent.—P. FIREMAN.

The humidity of the soil and subsoil in wooded and bare steppes in Russia, G. WISSOTZKY (*Ann. Sci. Agron., 1900, II, No. 1, pp. 120–138, figs. 4*).—The drying action of forests on the soil moisture is shown in this article, also that there exists in soils what is termed a "dead" zone which is never reached by the percolating rainfall.

Description of a soil map of the Connecticut Valley, M. WHITNEY (*U. S. Dept. Agr., Division of Soils Circ. 7, pp. 4*).—This circular describes briefly the conditions in the Connecticut Valley and the soils represented on a map published in connection with a more detailed report on the subject (see p. 522).

Canadian soils, F. T. SHUTT (*Canada Expt. Farms Rpts. 1899, pp. 132, 133*).—Analyses of 3 samples of soil, 1 from Manitoba and 2 (virgin and cultivated soil) from New Brunswick, are reported and discussed.

Economical improvement of exhausted soils, F. T. SHUTT (*Canada Expt. Farms Rpts. 1899, pp. 133–137*).—This is a general discussion of this subject, treating of the effect of continuous cropping without the application of manure and the features which characterize partially exhausted soils, including poor texture, deficiency of humus and nitrogen, and sourness and deficiency of lime.

Reports of the work of the western expedition for the reclamation of marshes, 1873–1898, I. I. ZHILINSKI (*Selsk. Khoz. i Lyesov., 198* (*1900*), *July, pp. 229–234*).—This is a review of two reports, aggregating about 1,040 pages, with an atlas containing 77 maps, plans, etc., published by the Ministry of Agriculture and Imperial Domains at St. Petersburg. The work done by this expedition was confined chiefly to that section of European Russia which embraces the governments of Minsk, Grodno, and Volyn. The entire work cost 4,780,000 rubles ($3,680,600).—P. FIREMAN.

FERTILIZERS.

On the availability to grass of nitrogen in form of nitrate of soda, cotton-seed meal, and fine, hard bone, E. H. JENKINS and W. E. BRITTON (*Connecticut State Sta. Rpt. 1899, pt. 3, pp. 197–203*).—The experiments here reported were in continuation of those of previous years (E. S. R., 11, p. 722). January 7, 1899, nitrate of soda, cotton-seed meal, and raw-knuckle bone flour were each applied to 4 pots seeded to grass, of the series used in the previous experiments, at rates furnishing 0.1333 gm. of nitrogen per pot. The experiments were conducted and the yields and nitrogen content of the crop were recorded as in previous years.

"The yields in 1899 were without exception much less than in 1898. This may have been due to a lack of available potash in the second year, to difference in the amount of sunlight, or to possible change in the mechanical condition of the soil, caused by the watering.

"The important fact brought out by the cultures is that in this soil and under the conditions of our experiment, while the nitrogen of nitrate of soda and cotton-seed meal very largely increased the crop and the crop nitrogen, the nitrogen of fine, hard, raw-knuckle bone had absolutely no effect of this kind.

"There is no evidence that the fertilizer nitrogen of hard raw bone, applied 2 years ago, has yet been assimilated in any amount by grass which has been growing continuously in the soil with it."

On the availability to Hungarian grass of nitrogen in form of nitrate of soda, cotton-seed meal, and raw, boiled, and steamed bone, E. H. JENKINS and W. E. BRITTON (*Connecticut State Sta. Rpt. 1899, pt. 3, pp. 204–210*).—This is a continuation of experiments of previous years (E. S. R., 10, p. 234). The soil used was a light sand containing 0.1095 per cent of nitrogen and having a faintly acid reaction to litmus paper. To the soil of each pot were added 6.6 gm. of freshly slaked lime free from magnesia, 1.8 gm. of muriate of potash containing 48.54 per cent of potash, and 1.2 gm. of dicalcium phosphate containing 41.5 per cent of phosphoric acid, besides the nitrogenous fertilizers tested. The experiments were conducted as in previous years. The results are summarized in the following table:

Percentages of crop increase and of fertilizer nitrogen recovered in Hungarian grass.

Fertilizer used.	Nitrogen content.	Rate of application per acre.	Crop increase.	Fertilizer nitrogen recovered in crop.
	Per cent.	*Pounds.*	*Per cent.*	*Per cent.*
Nitrate of soda	16.08	462	46	79
Do	16.08	231	25	62
Cotton-seed meal	8.42	871	28	38
Do	8.42	436	18	44
Hard raw bone	4.16	1,760	−1.7	1.3
Do	4.16	880	.7	−26.6
Soft raw bone	3.98	1,840	16.3	8.8
Do	3.98	920	4.3	10.0
Steamed bone	2.31	3,170	19.1	8.5
Do	2.31	1,585	4.8	−13.9
Boiled bone	2.77	2,650	5.3	− 1.2
Do	2.77	1,325	3.0	−32.3

"Inspection of these figures shows that from 62 to 79 per cent of the fertilizer nitrogen in form of nitrate of soda and from 38 to 44 per cent of the fertilizer nitrogen in form of cotton-seed meal were available and taken up by the crop.

"The results where bone nitrogen was applied are very irregular, and much less nitrogen was present in some crops which had grown in pots to which bone was added as a fertilizer than in crops from pots which had no fertilizer nitrogen added to them. In no case where bone was used as a fertilizer did more than about 8½ per cent of the fertilizer nitrogen become available to the crop. In every case the larger application of bone had a better effect than the smaller one."

On the availability of the nitrogen of hard raw bone as affected by applications of slaked lime, E. H. JENKINS and W. E. BRITTON (*Connecticut State Sta. Rpt. 1899, pt. 3, pp. 211–216, pl. 1*).—Experiments on this subject, similar to those described above, were made with 3 light sandy loams deficient in available plant food. The pots used were brought to a uniform weight of 5 lbs. by putting in gravel, and 14 lbs. of soil containing 15.69 per cent of moisture was placed in each pot. The fertilizers used per pot were 1.8 gm. of muriate of potash, 1.2 gm. of dicalcium phosphate, and 6.4 of fine, hard knuckle bone. Two pots received no lime; two, 6.6 gm. of lime; two, 13.2 gm.; two, 19.8 gm.; and two 26.4 gm. of freshly slaked but

dry lime containing only traces of magnesia. Hungarian grass was the plant grown. From the data for crop increase and nitrogen in the crop the following conclusions are drawn:

"(1) An application equal to 1,800 lbs. of slaked lime per acre decreased the yield of grain by 11 per cent, of straw (including roots and stubble) by 19 per cent, and of crop nitrogen by about 14 per cent.

"(2) An application equal to 3,600 lbs. of slaked lime per acre, instead of further decreasing the yield, increased the yield of grain by 13 per cent and of crop nitrogen by 10 per cent, while the yield of straw and stubble was 14 per cent less than where no lime was applied.

"(3) Applications equal to 5,400 and 7,200 lbs. of slaked lime per acre increased the crop as follows:

Percentage increase over crops from soil to which no lime was added.

	5,400 lbs. of lime per acre.	7,200 lbs. of lime per acre.
	Per cent.	*Per cent.*
Increase of grain	36.8	43.7
Increase of straw	1.2	1.9
Increase of crop nitrogen	38.1	54.1

"In these cultures, therefore, in which hard raw bone was used as a fertilizer, applications of large quantities of slaked lime (two and three times as much lime as bone) increased the grain in the crop by 36 to 44 per cent and the crop nitrogen by 38 to 54 per cent over the yield from pots to which no slaked lime was added; but the yield of straw was not increased by the use of lime. From this series alone can not be calculated the actual percentages of the fertilizer nitrogen recovered in the crop, for the yield of crop nitrogen from the soil without fertilizer is not determined nor the effect of the lime in making the soil nitrogen available. Further experiments are being made on these points. These cultures, however, prove that slaked lime has made very much more available the nitrogen of the soil, or more probably, the nitrogen of the bone which without lime was almost inert as a fertilizer."

The comparative value of nitrate of sodium and sulphate of ammonium as manures, R. WARINGTON (*Jour. Roy. Agr. Soc. England, 3. ser., 11 (1900), pt. 2, No. 42, pp. 300–346*).—A general discussion of this subject based largely upon the results of experiments at Rothamsted and Woburn. It is shown that ammonium sulphate is slower in action than sodium nitrate because it must first undergo nitrification. When the conditions are unfavorable to nitrification, that is, when the soil is deficient in lime and the season is dry, sodium nitrate, being soluble and immediately available as plant food, gives better results than ammonium sulphate. In a wet summer, however, and on a soil abundantly supplied with lime, ammonium sulphate frequently gives better results than sodium nitrate. "This influence of climate is most clearly seen in the case of cereal crops, or on grass lands; it is less perceived in the case of crops like potatoes and mangels, which have a longer period of growth." It is stated that the slower action of ammonium sulphate as compared with sodium nitrate is not entirely

due to the time required for the nitrification of the salt itself, but is partly due to its action in retarding nitrification in the soil.

"An application of nitrate of sodium does not apparently interfere with the ordinary course of nitrification in the soil, this goes on as if no nitrate has been employed; but when an ammonium salt is applied to the soil, nitrification seems to proceed first on the ammonia, and the nitrogenous organic matter of the soil in contact with the ammonia is protected for a time from decomposition, and reserved for a later action. This effect of adding ammonium salts to a soil will be distinctly increased if the proportion of carbonate of lime in the soil is very small, so that the immediately available base is used up by the ammonium salts, and a fresh supply is obtained only by subsequent weathering."

Averaging the results of a long series of field experiments at Rothamsted, it is found that the effectiveness of ammonium sulphate as compared with that of sodium nitrate was for cereal crops as 93 to 100 for the grain and 79 to 100 for straw, for hay as 88 to 100, and for mangels 82 to 100. In experiments with potatoes the product from the ammonium sulphate was on an average fully equal to that yielded by sodium nitrate. In experiments on turnips in Scotland and the north of England, in which small quantities of ammonium sulphate and sodium nitrate were applied, the 2 fertilizers were about equally effective.

The profitableness of fertilizing, E. WOLLNY (*Illus. Landw. Ztg., 20 (1900), Nos. 83, pp. 789, 790; 84, pp. 800, 801; 85, pp. 809, 810*).—A popular discussion of this subject.

The decomposition of organic substances and the forms of humus in their relations with agriculture, E. WOLLNY (*Ann. Sci. Agron., 1900, II, Nos. 1, pp. 33–119, figs. 2; pp. 338–450*).—This is the conclusion of the article which has been referred to in previous numbers of the Record (E. S. R., 11, p. 917).

Niter earth, wood ashes, and phosphatic material, A. M. PETER and H. E. CURTIS (*Kentucky Sta. Rpt. 1898, p. XVI*).—Analyses of 4 samples of niter earth, 3 samples of wood ashes, and 1 sample of phosphatic material are reported.

Utilizing blast-furnace slag as a fertilizer, A. D. ELBERS (*Tradesman, 44 (1900), No. 7, pp. 91, 92*).—This article treats briefly of "the practicability of using highly calcareous slag for agricultural purposes in place of ordinary lime, chalk, and marl." It does not deal with the phosphatic slags.

Researches on the injurious effects of nitrate of soda, P. DE CALUWE (*Exposé Cult. Exper. Gand, 1898–99, pp. 54–66, pls. 3*).—A detailed account of the experiments noted above.

Commercial fertilizers in Indiana, H. A. HUSTON (*Purdue Univ. Spec. Bul. 1900, Aug., pp. 24*).—This is a report of analyses of 481 samples of fertilizers examined during 1899, with a discussion of the results.

"[Of the samples examined] only 39 were up to the legal standard in every particular. One hundred and twenty samples fell below the legal standard in one or more ingredients, but the differences are so small that a purchaser, while not getting the full amount legally due him, yet got so nearly that amount that he was not seriously misled in regard to the relative amounts of each ingredient present, nor was he subjected to any considerable financial loss. . . .

"Three hundred and twenty-two samples differ so much from the legal standards that the purchaser would be seriously deceived. In many cases less than one-half the legal amount of one or more ingredients was present."

Fertilizers and amendments, F. T. SHUTT (*Canada Expt. Farms Rpts. 1899, pp. 137–143*).—Analyses of the following fertilizing materials are reported and their value

and use briefly discussed: Marsh mud, swamp muck (19 samples), tannery ashes from the furnace and from the heap, wood ashes, fish pomace, sewage sludge, and poudrette.

FIELD CROPS.

Field experiments at the experiment farm at Lauchstädt in 1897 and 1898, M. Maercker (*Landw. Jahrb., 28 (1899), No. 5–6, pp. 617–943, 995–1047, dgm. 1*).—A special feature of the experiments has been the different methods of fertilizing adapted to crops grown in succession according to the Norfolk system of rotation, *i. e.*, winter wheat, sugar beets, spring barley, and potatoes. Other special features have been the utilization of barnyard manures from different sources and when preserved by different methods. Earlier work has been noted (E. S. R., 10, p. 533).

When alfalfa hay was grown on a clay soil at the station its chemical composition was but little affected by fertilizing with Thomas slag alone or combined with kainit and gypsum. Its feeding value was decreased, if anything, by the use of these fertilizers. The use of 600 kg. of Thomas slag and 1,000 kg. of kainit combined per hectare greatly increased the yield of an old alfalfa field and had a remarkably good effect on newly seeded fields. Thomas slag alone gave indifferent results. The addition to the Thomas slag and kainit of 1,000 kg. of gypsum per hectare increased the yield nearly 25 per cent. It is thought this same result would have been obtained by a larger use of potash. Fifty per cent of the potash in the kainit applied was utilized by the crop when gypsum was applied at the same time, whereas without it 44.3 per cent was utilized. The application of 2,000 kg. per hectare of Thomas slag at one time in combination with 1,000 kg. of kainit, in the expectation that about 500 kg. of the slag would be needed yearly for the crop, nearly doubled the yield the first year, paid the whole cost of the fertilizer, and left a profit of nearly $6 per hectare besides.

In the tests with varieties of winter wheat, Square Head sorts have regularly surpassed all other varieties in the yield of both grain and straw, and the use of Improved Square Head seed gave average results which exceeded by 263 kg. per hectare the yields obtained from seed wheat of the same variety generally grown in the vicinity of the station. In the opinion of the author the profit in growing wheat depends as much upon the use of selected seed as upon the cultural methods followed or the fertilizer employed. The Square Head varieties Strube and Beseler No. 3 stood up the best under heavy applications of nitrogenous fertilizers of all the varieties tested. Rimpau Bastard was the earliest variety grown and proved best adapted for poor soils. Fall applications of nitrate of soda have not proven profitable. Applying one-half of the nitrate of soda at the end of February

and the other half at the end of May increased the grain yield 308 kg. per hectare over applying the same total amount early in the spring. In general, no spring applications of nitrogenous fertilizers are made if the wheat crop presents a good appearance. Commercial fertilizers were most effective on wheat when the crops immediately preceding had received either green or barnyard manures. Increasing the application of nitrate of soda beyond 200 kg. per hectare, while profitable in a few cases, in general tended to produce straw, which lodged badly and caused a decrease in the yield of grain. Thomas slag was most effective in the presence of nitrogenous fertilizers. Phosphoric acid in a water-soluble form has given better results with wheat than applications of equal amounts of citrate-soluble phosphoric acid.

Variety tests with winter rye resulted in placing Heine Zeelander and Lowchow Petkuser at the head of the list of desirable varieties for growing at the station. Treating rye seed with Alinit did not increase the yields.

Of the peas grown, Strube Early Victoria was the earliest and best yielding variety. A light application of barnyard manure or of nitrate of soda in the early stages of growth was found very beneficial for peas, and is recommended.

Oats followed different combinations of leguminous plants used as nitrogen gatherers. The best yield of both grain and straw followed a mixture composed of 50 per cent horse beans, 25 per cent peas, and 25 per cent vetch. Results obtained with Nitragin were conflicting. An application of 200 kg. per hectare of nitrate of soda increased the crop of oats following alfalfa 101 kg. over an application of 100 kg. of nitrate of soda. Winter oats were not grown with profit.

Of a number of varieties of barley grown, Hanna stood first as regards yield, both in 1896 and 1897. In 1898 Selchower headed the list. Heine Improved Chevalier barley has regularly produced the largest yields of straw. The Hanna barley ripened from 5 to 10 days earlier than any other sort grown. It also proved especially well adapted for culture on light soils when fertilized with potash and phosphoric acid, a feature which it is thought will contribute largely toward furthering the culture of barley in Germany. The variety Goldthorpe, though below some others in yield, was, nevertheless, one of the most satisfactory grown. In extract material, color, fineness, and size of grain, it outranked every other variety grown. Its chemical composition was least injuriously affected by fertilizers. It stood up well under all conditions. It was not a good variety for light soils, but proved especially valuable on soils too rich in nitrogenous fertilizers for the satisfactory culture of other varieties. Potash fertilizers on barley usually increased the grain yield, and whenever that occurred an improvement of the quality of the grain for brewing purposes by

an increase in starch content and a corresponding decrease of the protein content followed. Sylvanit as a source of potash proved a complete substitute for kainit, and is preferred by the author for barley. While the yields obtained with nitrate of soda were somewhat larger in all cases than with Peruvian guano, the composition of the grain was much better on plats fertilized with Peruvian guano, the color of the grain was better, and the extract on an average 4.3 per cent higher. The author considers Peruvian guano a far better fertilizer for barley than nitrate of soda. Experiments during the unfavorable season of 1898 showed sulphate of ammonia to be as satisfactory a source of nitrogen as Peruvian guano. Winter barley gave better yields on light soils than rye, and was fairly satisfactory as a barley for brewing purposes.

In experiments with sugar beets large leaf development and high sugar content of the root were found to be interrelated. Beet seed grown by reliable seedsmen gave better yields and produced beets having a higher sugar content and percentage purity than seeds of the same variety grown by a sugar-beet factory. Potash applied to sugar beets increased the yield considerably, but tended to decrease the sugar content of the beet roots. Up to a certain limit each application of 100 kg. of nitrate of potash increased the average yield of sugar beets 2,500 kg. per hectare. Sugar beets grown after catch crops turned under in the fall resulted in considerably increased yields over sugar beets grown after catch crops plowed under in the spring. Considerable decrease in yield regularly followed the omission of phosphoric acid from fertilizer formulas employed. The use of phosphatic fertilizers exerted no regular or marked influence on the sugar content of the beet roots. Superphosphate proved better than Thomas slag as regards the yield of roots. Catch crops used as nitrogen gatherers for sugar beets regularly increased the yield. They were most effective with regard to yield and profit when accompanied by applications of phosphoric acid.

Sheep manure on sugar beets increased the yields over deep-stall manure and had no depressing effect on the percentage sugar content and purity. Supplementing either deep-stall or common-stall manure with 200 kg. of nitrate of potash per hectare resulted in a profit, but doubling or trebling this amount did not increase the profits.

Of the varieties of potatoes grown in 1897, Prof. Maercker and Geheimrat Theil gave the best yields, 26,400 and 22,833 kg. per hectare, respectively. In 1898 Silesia led with a yield of 34,317 kg. per hectare. The use of kainit decreased the average starch content of the potatoes grown 1.91 per cent. On the station soil phosphoric acid used alone increased the yields 504 kg. per hectare. When used in combination with barnyard manure it increased the yields 2,060 kg.

per hectare. The use of nitrate of potash proved most profitable when combined with phosphoric acid, barnyard manure, or green manures.

In 1897 and 1898 barnyard manure from deep stalls produced yields of 321 and 465 kg. per hectare, respectively, more than barnyard manure obtained from common stalls. Plowing under catch crops in the fall, rather than the spring, has given best results for potatoes.

Some experiments were made with field-crop seeds. A portion of the seeds grown at the station were sent out to farmers for comparison with the seeds usually employed by them. In general, the station-grown seeds gave considerably better results.

In investigations with green manures it has been found that these manures possess the same high value for better soils as for lighter soils. Green manuring was found profitable with every crop, but proved especially valuable for sugar and fodder beets, potatoes, and carrots.

The most suitable plants for green manuring consisted of a mixture of 50 per cent of horse beans, 25 per cent of vetch, and 25 per cent of peas. Plowing the green manure under in the fall gave best results, except with crimson clover or a mixture of hairy vetch and rye, which, when sown late in the season, made its greatest development in the spring. Phosphatic and potash fertilizers were profitably used with green manures, but nitrogenous fertilizers were hardly necessary.

The experiments to determine the economic use of barnyard manure involved the utilization on different crops of barnyard manure from deep and from common stalls, of sheltered and unsheltered manure, barnyard manure sprinkled with a weak solution (1½ to 2 per cent) of sulphuric acid, and manure preserved with a mixture of marl and peat and with "sulfarin," a fertilizer-preserving mixture composed of sulphate of magnesia containing 15 to 18 per cent of free sulphuric acid. The best results with sugar beets and potatoes have been obtained with barnyard manure from deep stalls preserved under shelter. When barnyard manures were used, the further addition of commercial nitrogenous manures was not profitable. Additions of phosphoric acid, on the other hand, gave largely increased returns. Treating barnyard manures with a 1½ to 2 per cent solution of sulphuric acid preserved the ammonia in the manures and profitably increased the yields. The use of "sulfarin" in preserving barnyard manure rendered the manure much more effective, but its high cost made the use of sulphuric acid for this purpose more economical. Treating stall manure with 5 per cent of its weight of marl increased the potato crop 241 kg. per hectare. When 2 per cent of peat moss was added, the yield was increased 430 kg. per hectare. These results were not quite as good as those obtained with the barnyard manure treated with sulphuric acid. The method used for incorporating sulphuric acid with the manures has been noted elsewhere (E. S. R., 11, p. 725).

When marl is used as a barnyard-manure preservative about 20 lbs. per head per day is required for large stock, when the marl contains but 20 per cent of carbonate of calcium. If the marl contain 50 per cent of carbonate of calcium, only about 12½ lbs. per head per day are required. Marl is much more effective if used in connection with peat moss. About 2 lbs. of peat moss should be kept in the gutter behind each animal to absorb all liquid manure and should be changed about twice each week.

Field experiments with farm crops, W. SAUNDERS, J. H. GRISDALE, W. T. MACOUN, R. ROBERTSON, S. A. BEDFORD, A. MACKAY, and T. A. SHARPE (*Canada Expt. Farms Rpts. 1899, pp. 5-33, 35-38, 65-72, 105-109, 113-117, 229-249, 283-310, 337-362, 389-410, figs. 6*).—As in previous years, variety, cultural, and fertilizer tests with cereals, root, and forage crops have been carried on at the government experimental farms in Ottawa, the Maritime Provinces, Manitoba, British Columbia, and the Northwest Territories (E. S. R., 11, p. 831). The results of the variety tests with the different farm crops in 1899 have been previously recorded (E. S. R., 12, p. 134). The cultural experiments consisted of early, medium, and late sowings of oats, barley, spring wheat, peas, turnips, mangels, carrots, sugar beets, potatoes, and flax; distance experiments with corn, soy beans, horse beans, and potatoes; early and late harvesting of root crops; rotation tests; thick and thin seedings of grasses; spring and fall plowing and summer fallowing; growing mixed grain crops together, etc. The fertilizer experiments include tests of barnyard manure and different commercial fertilizers and of the relative value of clovers, rye, peas, tares, alfalfa, rape, and brome grass as green manures. The results of these experiments are tabulated in detail and in some instances averaged for preceding years.

On the whole the crops obtained at the experimental stations in 1899 have been above the average for the country, due, it is thought, largely to a more thorough preparation of the soil, greater care in the preservation and use of barnyard manure, the careful selection of well-matured and plump seed of the most productive sorts, and early sowings. The relative earliness of ripening of the different cereals, which is considered almost as important as productiveness, has been further investigated and the result reached that, as a rule, "any great increase in earliness and ripening of grain is accompanied by a decrease in yield."

The results of experiments in early, medium, and late sowings of oats, barley, and wheat for 10 years, and of peas for 5 years at the Ottawa farm are summarized and are shown to have been uniformly in favor of the second sowing; that is, about 1 week after the ground is in that condition where sowing is practicable. A further delay of 1 week has caused an average loss with oats of over 15, barley 23,

spring wheat 30, and peas 4 per cent. With a delay in sowing of 4 weeks, the average loss with oats has been 48, barley 46, spring wheat 56, and peas 30 per cent. These results are largely in harmony with like data reported from the branch stations. Early sowings of mangels, carrots, and beets at all the stations have resulted quite uniformly in favor of the practice. At the Central Station the yield of potatoes decreased regularly with the lateness of planting after May 26, when the first crop was put in the ground. With the flax crop in 1899 the results in the Maritime Provinces, Northwest Territories, and British Columbia seem to be in favor of medium sowings.

In the distance experiments, corn was grown in rows 14, 21, 28, 35, and 42 in. apart, respectively. In general the heaviest yields of green silage corn were obtained from the rows 21 and 28 in. distant, when cut in the early milk stage. With soy beans and horse beans the largest yields at Ottawa, Manitoba, and the Northwest Territories were obtained when the rows were 21 in. apart. Twenty-four in. for soy beans and 30 in. for horse beans were found to be the best distances in the Maritime Provinces; while 35 for soy beans and 28 for horse beans were found best in British Columbia. Leaving a part of the turnips in the ground 3 weeks after the first pulling, October 14, resulted in considerably increased yields at the Ottawa Station.

Spring-plowed land has usually proved better than fall plowed for wheat in Manitoba, while summer fallowing has given better results than either. Seeding wheat with a press drill has given better average yields of grain for 8 years in the Northwest Territories than seeding with a hoe drill. Likewise at the same station seeding wheat 2 in. rather than 3 in. deep has given the better average results for the same period, while the use of $1\frac{1}{4}$ to $1\frac{1}{2}$ bu. of seed per acre has resulted more satisfactorily than when only 1 bu. per acre has been sown.

Of all the different fertilizers used at the Central Farm on spring wheat, barley, corn, mangels, and turnips, the best average results for 12 years have been obtained with barnyard manure (about equal parts horse manure and cow manure), and slightly better results have been secured from the use of fresh manure than from well-rotted manure. At the same station oats grown after grain crops seeded with clover in 1897 gave an increase in yield of straw of 17 per cent in 1898 and 35 per cent in 1899; and of grain of over 28 per cent in 1898 and 29 per cent in 1899, as compared with the yield from the grain plats on which no clover had been turned under.

Growing oats after pasture grass and clover has resulted in better yields of grain than growing after either brome grass, pasture grass, or barley seeded with clover. Potatoes grown after a crop of barley and clover gave a 28 per cent higher yield than when grown after peas and carrots.

On a rather rich moist sandy loam soil at the station in Manitoba,

green manuring for wheat and oats was without benefit, the best results being secured from summer fallowing. Soy bean was one of the best preparatory crops for barley. At the Experimental Farm for the Northwest Territories plowing under green crops preparatory for a crop of wheat was without benefit, the soil being seemingly sufficiently well supplied with humus and nitrogen. In the Maritime Provinces barnyard manure alone, and mixed with commercial fertilizers, has given better results with farm crops than complete commercial fertilizers or single elements.

Inoculating clover seed with Nitragin seemed slightly beneficial in Manitoba and the Northwest Territories, while in British Columbia better results were secured from untreated seed.

Some experiments were made at the different stations to learn the best amounts of mixed grasses to sow for the heaviest yields, and whether better results could be obtained from mixing grain than from seeding alone. In the Maritime Provinces seeding mixtures composed of 2 bu. of oats, 1 bu. of barley, and ½ bu. of peas, at the rate of 3 bu. per acre, gave higher yields of grain than smaller amounts. At the Manitoba Station there was an average difference in yield of but 55 lbs. per acre in favor of sowing mixed grains, rather than growing the grains separately. In British Columbia a mixture of 1 bu. each of peas, oats, and wheat gave a slightly higher yield than a similar mixture of peas, oats, and barley. In seeding experiments with different grasses the average results for 3 years at the Manitoba Station showed that with timothy and western rye grass, 10 lbs. of seed is sufficient, while with brome grass and bald rye grass, 20 lbs. gave the best results, and with American lyme grass, 15 lbs. was most desirable.

At the Central Farm an experiment was conducted in planting potatoes at different depths from 1 to 8 in. Level cultivation was adopted and so but little soil was thrown on the potatoes after they were planted. The best average yields for 2 years were obtained when the potatoes were planted but 1 in. deep. "Notes were taken on the depths at which tubers were formed and it was found that most of them were within 4 in. of the surface of the soil, even where the seed had been planted 6, 7, and 8 in. deep. Where the sets were planted less than 4 in. deep, nearly all the tubers were found between that and the surface of the soil."

Experiments with oats for the prevention of smut were carried on at nearly all the stations. Soaking oat seed for 1 hour in formalin (4½ oz. to 10 gal. of water) or ½ hour in a copper sulphate solution (1 lb. to 5 gal. of water) has quite uniformly prevented loss from this source.

A variety test with 48 varieties of tobacco was conducted at the Central Station, as to time of ripening and productiveness. The results are tabulated but no conclusions drawn.

Corn culture in North Carolina, B. IRBY (*North Carolina Sta. Bul. 171, pp. 27–43*).—This is a popular practical bulletin on corn culture, dealing in detail with the following subjects: Kinds of land suited for corn culture, preparation of the soil, planting, fertilizers to be used on corn, methods of corn cultivation, rotations for corn, varieties best adapted to the South, harvesting the crop, selection and improvement of seed, protection against weevils and moths, and the comparative food value of corn and other forage crops. Dent varieties of corn are considered best for the South, and for grain and stover purposes the One-Hundred-Day Bristol, Delaware County Dent, Leaming, Golden Beauty, Chester County Mammoth, White Cap Early Dent, among the yellow varieties, and Mortgage Lifter, Hickory King, Mammoth White Hite, Riley Favorite, Cory Klondike, Snow Flake, Mosby Prolific, and Red Cob, among the white varieties, are considered best. For grain and silage purposes Cocke Prolific, Northern White Field, Blount Prolific, White Dent, Red Cob Ensilage, and Southern Horse Tooth, are recommended.

Sowing the seed with a planter is advised when as much as 10 acres of corn is grown. The seed for planting should be selected from the stalks in the field rather than in the crib.

Crops for alkali soils, C. E. MEAD (*New Mexico Sta. Bul. 33, pp. 37–39*).—A brief account of the successful culture of sugar beets and sorghum on alkali patches or "chico spots," which are common on many of the farms in the northwestern part of New Mexico. Sugar beets grew especially well on these alkali spots, the roots being of large size and good shape analyzing 18 to 20 per cent of sugar in the juice with a purity of from 80 to 90.

In the sorghum experiment the soil of a "chico spot" was removed to a depth of about 1 ft. and distributed over the remainder of the plat as evenly as possible. The excavation thus caused was filled with soil containing very little if any alkali. It was leveled and the whole plat drilled to sorghum. "In the fall, when the cane was stacked, the stalks on the 'chico spot' were large and tall and most of them matured their seed, while those on other parts of the same plat were small, short, and of a sickly-looking color and in very few instances could a ripe head be found. There was a difference of fully 2 ft. in the height of the canes on the plat in favor of the ones grown over the 'chico' land, and the heads of these were large and well filled with grain, while the same can not be said of the others."

Grasses and forage crops, C. A. KEFFER (*New Mexico Sta. Bul. 32, pp. 19–34*).—The author discusses briefly the importance of combining live stock and crop interests on the same farm in New Mexico and urges the growing of certain forage c[illegible]s for summer feeding during periods of drought. Forage crops g[illegible]own at the station and considered valuable are *Bromus inermis*, Italian rye grass (*Lolium*

italicum), Perennial rye grass (*L. perenne*), reed fescue (*Festuca elatior arundinacea*), English blue grass (*F. pratensis*), orchard grass (*Dactylis glomerata*), Hungarian alfalfa and alfalfa from India and Africa, Japanese barnyard millet, sorghum, Kafir corn, milo maize, and cowpeas. The cultural operations employed with a number of these crops are given, together with notes on the grazing of horses on the Japanese barnyard millet and of feeding sorghum to milch cows. The sorghums were greatly relished by the cows and temporarily increased the milk flow. Feeding the sorghum with alfalfa was found more desirable than feeding either alone. Kafir corn fodder containing fully ripe seed was relished by horses. The leaves and seeds were eaten clean and likewise the upper portions of the stalks. No difference was noticed in the relative growth of brown and white Kafir corn.

The effect of a second irrigation of alfalfa to induce germination was studied. After the first irrigation the plats formed a hard surface crust about ¼ in. thick and cracked into large cakes in drying. Some seed germinated and were just showing their seed leaves in the cracks when a portion of the plat received a second irrigation. Plats thus irrigated gave a poorer stand of alfalfa without exception than those irrigated but once. This was due largely to the filling up of the cracks in the crust with sediment and thus smothering many of the young alfalfa plants.

Observations on the loss in the first stages of growth of alfalfa plants due to crowding show that the alfalfa plant is extremely tenacious of life and has great endurance in extremes of drought, there being but few deaths even where the plants were most crowded.

The value of the cowpea as a hay crop and green manure is discussed and some cultural data given on inconclusive experiments in growing this crop at the station.

Results of manuring, C. E. Mead (*New Mexico Sta. Bul. 33, pp. 41–43*).—Oats were grown on land a part of which had borne a crop of hairy vetch the preceding season. At the time of heading the oats on the vetch portion of the plat averaged about 3½ ft. in height, while the remaining portion of the plat averaged about 2 ft. At harvest the yield on the vetch land was 25 bu. per acre, while the remainder of the plat gave but 18 bu. per acre.

In another experiment oats were grown after field peas, the vines and pods of which had been turned under. The yield of grain from this plat was at the rate of 47 bu. per acre. The yield the preceding season on similar soil not fertilized with pea vines was at the rate of 9.6 bu. per acre.

Other experiments with corn grown on land fertilized with barnyard manure and on new land are reported. The barnyard manure had a good effect on the physical condition of the soil and considerably increased the yield of corn, about the same results being obtained as when corn was grown on new land.

Sugar-beet investigations, J. D. TOWAR (*Michigan Sta. Bul. 179, pp. 93-113, figs. 6*).—These investigations include fertilizer experiments with beets on different soils at the station and in cooperation with farmers in different parts of the State, variety tests, and trials of plantings at different dates.

Subsoiling is shown to be practicable and not so difficult as is usually supposed. Spring subsoiling for beets proved disastrous at the station in 1899, as the ground did not regain a sufficient amount of moisture to support the crop.

In a fertilizer test at the station on sandy soil of medium fertility, cow manure, salt, ashes, lime, hen manure, complete fertilizers, and a commercial brand of sugar-beet fertilizer were used, besides various single elements applied alone and combined in two's. The details of the results obtained are tabulated. On the plats receiving the lime a slightly greater development of leaf was observed than occurred on the unlimed plats. At harvest time an average increased yield of 1,210 lbs. of beets per acre was obtained on the limed plats, while the percentage of sugar remained practically the same. There was a slight decrease in the percentage of purity. In this and other experiments at the station nitrate of soda has proved superior to sulphate of ammonia for sugar beets as regards yield, sugar content, and purity. Beets on plats fertilized with nitrate of soda in this experiment germinated earlier and made a greater development all through the first half of the season than on any of the other plats.

Fertilizer experiments were also conducted on thoroughly subdued and well drained muck land at the station, using nearly all of the fertilizers noted above. During the season the beets seemed to suffer more from drought on this muck soil than on heavier land, while at harvest time they were apparently making stronger growth than at any previous period. It is thought that if the season had been prolonged a month good yields of beets would have been obtained. The highest yield, 23,814 lbs., was obtained on the plat fertilized with unleached wood ashes at the rate of 1 ton per acre. The use of potash regularly resulted in increased yields. An injurious effect seemed to follow the use of phosphoric acid. Applications of a layer of sand proved especially valuable on this soil. The use of lime resulted in decreased yield, and in beets having a low sugar content and purity.

In culture experiments at the station plantings of beets were made weekly from April 22, when the soil temperature was about 50° F., to May 27. There was a decided advantage as regards yield in favor of the earlier plantings, while the sugar content was slightly higher and the percentage of purity averaged 3 per cent higher. The author considers it safe and wise to plant beets as early in the spring as any other farm crop.

In order to determine the effect of fall growth of beets samples

were analyzed at different times. From October 19 to November 1 the sugar content of the beets averaged 14.74 per cent, the purity 82.23, and from November 4 to 23, 13.89 and 81.03 per cent, respectively. It is thought that this decrease in sugar content and purity was more than made up by the increased growth of the beets. On muck soil this increase in growth from October 20 to November 23 amounted to 2,893 lbs. per acre. The analyses of about 460 samples of sugar beets between October 15 and December 1 showed a similar decrease in sugar content and purity as the season advanced.

Seven varieties of sugar beets were grown in 1898 and again in 1899. In 1898 Zehringer, Kleinwanzlebener, Vilmorin Improved, Vilmorin Blanche, and Schreiber Élite were the best varieties grown, while in 1899 Zehringer, Russian, Rölker EE, and Rölker ZZ gave the most satisfactory results.

The relation of the size of the beet to its sugar content was studied, and some figures are given on the subject. In general the smallest beets were richest in sugar and the largest poorest in this constituent.

In the cooperative experiments beets were grown on sandy soil, sandy loam, and clay loam, and various fertilizers applied alone and in combinations. Data regarding the yield, sugar content, and purity of beets grown on each plat are tabulated. No particularly significant yields were obtained on any of the plats. The best results followed the application of 480 lbs. per acre of a mixture of 120 lbs. of nitrate of soda, 240 lbs. of phosphatic rock, and 120 lbs. of muriate of potash. Relative to the use of nitrate of soda the author states that when used alone it "generally produced beets of a low percentage of sugar, but when used in connection with sufficient amounts of the other 2 elements normal beets are produced."

The yields of beets obtained on clay loam, sandy loam, sand, clay, and muck in the cooperative experiments with farmers in 1897 and 1898 are summarized. The results indicate that "a mixture of equal parts of sand and clay, or varying 10 per cent from equal parts, is a superior sugar-beet soil." Fairly good results were obtained in these experiments on muck soil, a result which it is thought will prove of considerable economic importance to the State because of the abundance of these soils.

Results secured with sugar beets at other stations are noted and illustrations given of diseased roots and roots grown under unfavorable cultural and soil conditions.

Sugar beets in 1898, R. H. McDowell and N. E. Wilson (*Nevada Sta. Bul. 43, pp. 30, map 1, pls. 5, figs. 2*).—Cultural experiments with sugar beets are reported in continuation of previous work (E. S. R., 10, p. 631). As a rule 8 irrigations are given sugar beets in Nevada. Eight varieties were grown in 1898. The sugar content of the juice of 25 samples grown at the station and over the State averaged 17.67

per cent, with a purity coefficient of 79.18 per cent. The ripening of 2 crops of beets in one season is reported by a grower in Lincoln County. Suggestions regarding seed, cultural operations, and implements, factory devices for unloading beets rapidly, etc., are included in the bulletin, and a map showing the sugar-beet area of the State. Portions of the State are considered very well adapted to sugar-beet culture.

Sugar beets in 1899, N. E. WILSON and R. H. MCDOWELL (*Nevada Sta. Bul. 44, pp. 21, figs. 2*).—In previous years (see above) experiments have been conducted largely for the purpose of making a survey of the State relative to its sugar-beet producing powers. In 1899 the principal attention was given to the possibility of producing beets of a high saccharine content on a commercial scale in those sections which had previously shown most promise. Considerable tabular matter is given, which shows that the average of 183 samples analyzed in 1899 contained 16.2 per cent of sugar in the beet, having a purity of 84.68 per cent.

"The locality giving the best results is the Lovelock Valley, situated in the southeastern part of Humboldt County, on the Humboldt River. The soil in this valley is peculiarly rich and fertile, and has been formed by the growth and decay of tules, which have been covered by sediment, thus forming alternate layer after layer of decayed tule and sedimentary silt to a great depth. In one instance borings have been made to the depth of 480 ft., showing the same formation the entire distance. The soil is free from rocks, and is very friable and porous, thus affording an excellent opportunity for the beet to go down into the soil, resulting in an ideal shape, with no side roots. Many of the beets from this section this year were from 18 to 27 in. in length and in good proportion otherwise. From 20,000 to 30,000 acres of this land could be obtained for beet growing in the advent of a factory for the manufacture of the product."

The factory conditions of a number of other localities are noted, and remarks made on water and limestone for factory use.

On the effects on tobacco of shading and the application of lime, W. C. STURGIS (*Connecticut State Sta. Rpt. 1899, pt. 3, pp. 252–261*).—The report is in part a continuation of work previously noted (E. S. R., 11, p. 755). The soil used was a close clay one, packing hard after rains, and similar in character to the East Hartford tobacco lands where the calico disease prevails. The land was laid out in 2 long plats running north and south with a 6-ft. alley between them. The western plat was shaded with a screen of lath, cutting off half of the light and placed about 5 ft. from the ground. Both plats were divided into 4 smaller plats, receiving, in addition to other fertilizers, 300, 500, 1,000, and 2,000 lbs. of air-slaked lime per acre, respectively.

On the unshaded plats which received the heaviest applications of lime the calico disease did not occur, although there were a few rusty leaves. Rusty leaves were also noticed on the shaded plat which received the most lime. On the unshaded plat which received lime at the rate of 500 lbs. per acre 17.5 per cent of the leaves were affected

with calico, while on the corresponding shaded plat only 2.5 per cent were affected. Ten per cent of affected leaves occurred on the unshaded plat given but 300 lbs. of lime and 5 per cent on the corresponding shaded plat. On the whole, the shaded plats contained a smaller percentage of leaves affected with calico than the unshaded. The author considers that the experiments were conducted on too small a scale to form the basis for final judgment.

Another effect, apparently due to shading, was the increased prevalence of the so-called "natural spot." Fully 30 to 40 per cent of the shaded plants were sprinkled with small whitish spots of dead tissue, while not more than 1 or 2 of the unshaded plants showed them.

Relative to the effect of shading on the growth of the plants and the quality of the leaf it was found that the shaded plants grew much slower than the unshaded, and showed the bud lower down and were therefore topped unnecessarily low. After topping the shaded plants filled out and produced unusually large, thin leaves of a very dark color. The unshaded plants were ready for cutting 2 weeks before the shaded plants. The difference in the weight of cured leaves from the shaded and the unshaded plats was quite marked. The average weight of plants from the shaded plats was 0.27 lb. and from the unshaded plats 0.34 lb. The stalks also of the shaded plants were noticeably smaller and lighter than the others, a fact due in great measure, it is thought, to lower topping. The greatest yields from both the shaded and unshaded plats were obtained where the larger amounts of lime were applied.

"The total thickness of the leaf was decreased by shading by over 30 per cent; the upper epidermis by 31 per cent; the palisade layer by 35 per cent; the spongy parenchyma by 27 per cent; the lower epidermis by 14 per cent."

The quality of the finished product was judged by experts.

"The tobacco, on the whole, was pronounced of poor quality; that from the unshaded plats was coarse, with harsh and wiry veins; that from the shaded plats was objected to as having been immature when cut and consequently of very poor color and of so thin and smooth a texture as to be practically worthless. It was noticeable that in the case of both the shaded and the unshaded tobacco the plats which received the largest quantity of lime showed a good deal of 'white vein.' The best of the unshaded tobacco was adjudged to be that which had received lime at the rate of 1,000 lbs. per acre. The best of the shaded tobacco was that which received lime at the rate of 2,000 lbs. per acre. On the whole, the shaded tobacco was pronounced far inferior to the unshaded. This latter opinion did not prove to be shared universally; one expert buyer, who knew nothing of the history of the tobacco, pronounced in favor of the shaded tobacco, both as regards texture and quality. . . .

"No difference could be observed, as regards the character of the ash, between the tobacco which had the least amount of lime and that which had the most; in both cases the ash was grey, flaky, and deficient in firmness. The burn of the tobacco from all the plats was equally poor."

The results of the experiment suggest "that the use of lime may not, in all cases, exercise the deleterious effect on tobacco that some grow-

ers suppose it to, and that there is some reason for thinking that its use may tend to decrease the prevalence of calico."

Experiments in curing and in fermenting wrapper leaf tobacco, season of 1899, E. H. JENKINS (*Connecticut State Sta. Rpt. 1899, pt. 3, pp. 286-297*).—These experiments in curing tobacco in a barn provided with hot-air flues and in fermenting Connecticut tobacco in bulk are similar in character to those carried on by the station in 1898 (E. S. R., 11, p. 730). The curing barn is again described and some data are given on outside and inside temperatures of the barn on different days and at different times during the night. The night temperature of the air inside the barn is usually much warmer than the outside temperature, while the reverse is frequently true in the daytime. The general method in controlling the curing is to open the barn wide on clear bright days and air it thoroughly. As soon as the outside temperature falls to that of the inside, the barn is closed except under the sills and in the ridge; the fires are started and run through the night. "The object was to assist the upward air current which naturally moves at night and to keep the tobacco from the night chill, thus making the temperature of the curing much more nearly uniform." Curing under these conditions in 1899 was much more rapid than where no artificial heat was used and proved valuable as a means of controlling the pole burn. The system of heating adopted is not entirely satisfactory as certain dead-air spaces occur which favor the development of pole burn. The experiments in curing are to be continued.

Some observations on the temperature of tobacco fermented in cases were made during the spring and summer of 1899. The cases held about 300 lbs. and were piled in an unheated storehouse, as is customary in Connecticut. Weekly readings for 4 cases from March 4 to August 5 taken with telephone thermometers are recorded. Some of the tobacco lay 9 weeks after the experiment began before reaching a temperature of 70° F. It is believed "the greatest danger to cased tobacco from mold and mustiness is when it lies cool, damp, and unfermented, waiting for sufficient heat from the air to penetrate it and start the fermentation."

The experiments in fermenting Connecticut tobacco in bulk noted in 1898 (E. S. R., 11, p. 730) were repeated in 1899 in cooperation with the Division of Soils of this Department. The bulk was built up on a slightly raised platform 12 ft. long and 5 ft. wide, with vertical headers of boards at each end. A layer of hot trash tobacco, which had been sprayed with warm water and allowed to ferment for 4 days, when it reached a temperature of 131° F., was first put down and then alternated with layers of first wrappers, butts on the outside, the tips toward the center. No pressure was applied. The hands of tobacco were simply laid on the pile. Number 2 wrappers, which were too dry to ferment, "were brought into 'case' by dipping the butts about 2 in.

deep into warm water and then holding the hands by their butts and shaking them vigorously until the water was well distributed." They were piled on the bulk without layers of trash. The whole bulk weighed about 5,500 lbs. It was covered with trash, woolen blankets and rubber blankets. The temperature of the room was maintained at from 80 to 85° F. and the humidity such that a hand of unfermented tobacco hung in the room remained pliable.

Five days after the bulk was built, the temperature near the bottom of the pile had reached 115° F., while near the top it was 121° F. At this point the bulk was torn down and the leaves shaken out a little and the pile rebuilt. Between December 23 and January 1 the temperature in different parts of the pile ranged from 110 to 118° F. The bulk was again rebuilt, and the highest temperature reached during the next 23 days was 113° F. (near the top), while near the bottom of the bulk the highest temperature reached was only 91° F. Examination of the leaf during the latter part of January showed that the gum was gone and the whole body of the leaf thoroughly fermented. Later the fermented tobacco was examined by experts.

"The unanimous opinion of all these gentlemen was that the [fermentation] process was a remarkably successful one. The leaf was of a perfectly even color from the tip to the stem end.

"The gum was all gone, the leaf was light and elastic, and there had not been the slightest damage during the fermentation. Particular attention was given to the leaves on which the butts of the next layer of leaves rested, as the dealers thought that there some damage must have been done. Careful search was made, but not a single damaged leaf could be found in the bulk. Another point was that of water stain. As stated above, all the hands—except those of first wrappers—had their butts dipped in warm water and the leaves shaken out, immediately before putting into the fermenting room. A few of the second wrappers came out of the fermentation with some water stain near the midrib of the leaf, but none on the margin, but the most of the dipped leaves showed no traces of water stain. The second wrappers were dipped just at nightfall and in great haste and probably not sufficient care was taken in shaking them out. If they had been left a few days longer in the first bulk, probably there would have been no water stain, even in the overwet leaves.

"Our experience has shown that unfermented leaf will bear a good deal of wetting if it is warm and goes at once into active fermentation. But under no other circumstances will it bear wetting."

By comparing the weights of the fermented and unfermented leaf, it was found that a quantity of tobacco weighing 3,076 lbs. before casing and fermenting in bulk was decreased in weight only 8 lbs. after fermenting and 3 of the grades of tobacco fermented were damper at the end of the process than before they were dampened at the beginning of it. The fermented tobacco dried out somewhat rapidly in the cases.

Physiological studies on Connecticut leaf tobacco, O. Loew (*U. S. Dept. Agr., Rpt. 65, pp. 57*).—A report is given on some physiological investigations of tobacco. The work deals with a number of

questions relating to the physiology of the leaf and the chemico-physiological changes which take place in processes of curing and sweating.

The acidity in the plant was greater in the morning than in the evening. "The custom of harvesting tobacco on bright sunny days has, therefore, a sound physiological foundation." The upper leaves contain more acid than the lower leaves. The acidity of the lamina decreased as the process of curing in the plant proceeded.

The presence of diastase in tobacco leaves was determined by the author, as was also a proteolytic enzym. The latter differs from the ordinary trypsin in that it can not attack fibrin and casein under ordinary conditions, while it can attack dissolved albumen. The presence of a cellulose-dissolving enzym (cytase) in tobacco leaves was not determined with certainty. In tests with oxidase and peroxidase both seemed to have the main character of albumoses. Oxidase in the juice of the tobacco leaf diluted with about 20 parts of water was killed by heating to 66 to 67° C. for 3 minutes. The presence of certain alkalies increases the resistance of oxidase to heat, while acids decrease it. Peroxidase in an alcoholic mixture was killed at the temperature of 70° C., while in a mixture of ammonium sulphate the enzym was not killed after heating for a short time to 93° C.

Since manganese has been found as a regular ash constituent of the oxidases, it was thought desirable to see what would be the influence of fertilizing tobacco with solutions containing manganese. A 0.1 per mille solution of sulphate of manganese was used to water some tobacco plants until each had received 0.6 gm. of that salt. Examination of the ripe leaf showed no noticeable increase of oxidase or peroxidase in the plants so treated.

A third oxidizing enzym in the tobacco plant, to which the name catalase is given, was observed. It occurred in the unfiltered juice of fresh tobacco leaves.

"This enzym is killed at 72 to 75° C. (161 to 167° F.). It is an oxidizing enzym, [but] it differs essentially from the ordinary oxidase and peroxidase.

"This enzym is the most durable of those in the tobacco leaf under ordinary circumstances, since it occurs in tobacco even over 6 years old, in which no trace of other enzyms, not even of the peroxidase, can be found.

"It is certainly an important factor in the heating up of the tobacco pile, as recent experiments with fermenting tobacco have shown.

"The general occurrence of this enzym in plant as well as in animal cells suffices to indicate a highly important physiological rôle. It is probably intimately connected with the process of respiration. The following two hypotheses as to its function appear the most probable to the writer: (1) Since many oxidative processes lead to the formation of hydrogen peroxid as a by-product, it is important that such a poisonous by-product be at once destroyed when accidentally formed in the cells in the course of the respiratory oxidations. (2) This enzym may have the office of loosening affinities in fatty acids and sugar in order not to tax the chemical energy of the protoplasm itself too heavily when these compounds are consumed for the purpose of respiration."

The mosaic disease of the tobacco plant is discussed in considerable detail, some figures being given to show the decreased malic-acid content of the pith, midrib, and lamina of the leaves of diseased over healthy plants.

Tests for oxidase in fresh-cured and fermented tobacco are given in detail, and some results obtained in testing for these enzyms in different tobaccos are reported. Methods of testing for catalase and the results obtained with various tobaccos, as well as of cigars of commerce, are also recorded. The "grain" of tobacco was found to be formed during the curing process.

Other subjects discussed in this bulletin are the contents of the tobacco leaf, ripening, behavior of the oxidizing enzyms in the curing process, development of the brown color in curing tobacco, cromogens of tobacco, sunburn of tobacco leaves, "white veins," "saltpeter" on tobacco, bacterial hypothesis of sweating tobacco, sweating musty tobaccos, aroma of tobaccos, nitrite content in sweated tobaccos, and the amount of heat produced by sweating in bulk.

Report on field experiments 1899, D. A. GILCHRIST (*Jour. Univ. Extension Col., Reading* [*England*], *Sup. 9, 1900, pp. 7-47, 52-54, 59-68*).—The experiments here recorded were made at a number of different centers. The data given cover the results obtained in fertilizer tests for meadow lands and pastures, oats, mangels, swedes, and potatoes; the use of various seed mixtures for hay and pasture; tests of varieties of oats; and rotation experiments. Suggestions for the manuring of various crops are added.

Kentucky forage plants—the grasses; analyses of some Kentucky grasses, H. GARMAN and A. M. PETER (*Kentucky Sta. Bul. 87, pp. 55-122, pls. 14*).—In part 1 of this publication notes are given on 141 species of native and introduced Kentucky grasses. Many of the grasses have been grown for a number of years on experimental plats at the station and their comparative values noted. Considerable data on the appearance, growth habit, and value as forage crops of the more important species are recorded, including some statistics on the State production of corn and wheat.

Part 2 gives the results of analyses with reference to food constituents of the air-dry and water-free material of 79 samples of grasses cut at different stages of growth and comprising 31 species. Analyses of the hay and seed are frequently included.

Drought-resisting forage plants at the cooperative range experiment station, Highmore, S. Dak., J. H. SHEPARD and D. A. SAUNDERS (*South Dakota Sta. Bul. 66, pp. 35-52*).—The data here given with the different forage plants have been reported by the Division of Agrostology of this Department (E. S. R., 12, p. 332). The mechanical and chemical analyses of the soils of Highmore are added.

Analyses of sugar cane and sugar beets, A. M. PETER (*Kentucky Sta. Rpt. 1898, pp. XVII-XXI*).—Tabulated results of analyses with reference to sugar content of 8 samples of sorghum and 105 samples of sugar beets.

The area of leaf surface on the topped tobacco plant, E. H. JENKINS (*Connecticut State Sta. Rpt. 1899, pt. 3, p. 297*).—This was determined by stripping off the leaves from the topped tobacco plant, carefully tracing the outlines of each leaf on rectangular sheets of paper whose area and weight were known and then cutting out the traced leaves with scissors. By weighing the leaf figures and cuttings separately it was calculated that the 18 leaves taken from the topped tobacco plant investigated had an area of 27.2 sq. ft. "Reckoning 7,700 plants to the acre it would

appear that the leaves from 1 acre of Connecticut Habana tobacco at harvest time would cover 4.8 acres."

Bacteria for lupines—inoculation tests with soil, C. SCHREIBER (*Rev. Gen. Agron., 9 (1900), No. 7, pp. 302–304*).—The use of 6,000 kg. per hectare of soil from an old lupine field resulted in an increase of yield of lupines grown on uninfected soil from 17,600 kg. per hectare where no inoculating soil was used to 40,100 kg. per hectare.

The effect of quicklime on the root bacteria of legumes, SALFELD (*Deut. Landw. Presse, 27 (1900), No. 75, p. 932*).—The author's experiments with quicklime on poor sandy soil in 1894 led him to the conclusion that it was harmful to the growth of root tubercles on field peas, lentils, garden peas, and *Lathyrus clymenum* (E. S. R., 6, p. 533). Later field and pot experiments have shown that the poor results obtained in 1894 on the limed plats must have been due to some other cause, since the legumes have been grown with 3 times as much quicklime applied per acre and the bacteria in nowise hindered in their action. On the other hand, the presence of the lime seemed to permit of their greater development.

HORTICULTURE.

Fruits, vegetables, flowers, and ornamental shrubs at the Experimental Farms in Canada, W. T. MACOUN, W. S. BLAIR, S. A. BEDFORD, A. MACKAY, and T. A. SHARPE (*Canada Expt. Farms Rpts. 1899, pp. 73–94, 100–104, 109–112, 123–127, 259–281, 315–334, 362–383, 411–424, figs. 12*).—Separate reports are here given for tests of large numbers of varieties of vegetables and orchard and small fruits. At the central station in Ottawa, and at each of the branch stations in the Maritime Provinces, Manitoba, Northwest Territories, and British Columbia, lists of seeds and cuttings distributed by the stations, and of the vegetables recommended to farmers are given, together with notes on the character and adaptability of various fruits, flowers, and shrubs to their respective localities. The report of the horticulturist, W. T. Macoun, at the Central Station includes an account by two farmers of the successful growing and fruiting of apples, plums, cherries, pears, and small fruits in high latitudes (48° 26''), where temperature variations ranged between —40° and +104° F. The secret of success in these regions seems to lie largely in removing the snow from the roots of the trees during the winter so that the ground will freeze to a depth of 4 or 5 in., after which snow and straw may be placed at the base of the trees in order to prevent alternate thawing and freezing before fine weather comes in the spring. Many varieties of apples do not succeed in Ottawa. They are subject either to sun scald, root killing, or killing of the terminal branches. Experiments in top grafting to overcome these obstacles are being conducted. Experiments in spraying plums, cherries, and apples with whitewash in winter to retard the blossoming period in spring are reported at the same station. The retarding of the swelling of the buds was quite marked with plums and cherries, but the difference in dates of bloom-

ing was very slight. A considerable number of the blossoms of the plum were killed by the whitewash. The whitewash appeared to have but little effect in retarding the swelling of the apple buds. A record of the relative dates of blossoming of the different varieties of apples at the Central Station is given.

Roses at the Maritime Experiment Farm have been successfully protected during the winter by placing barrels with the heads knocked out over the base of the bushes and packing with various materials, one of the most satisfactory of which was clean straw. Notes on the culture and dates of blooming of 58 varieties of hardy flowers are recorded, as is also data for an experiment on the effect of removing the suckers from the base of sweet corn in the production of ears. No conclusive results were obtained. Soaking sweet-corn seed 24 hours in warm water before planting proved of no value.

On the use of commercial fertilizers for forcing-house crops, E. H. JENKINS and W. E. BRITTON (*Connecticut State Sta. Rpt. 1899, pt. 3, pp. 219–235, plan 1*).—The work here reported was begun in 1894, and the results secured up to 1897 have been published (E. S. R., 10, p. 246).

Tomatoes (pp. 219–224).—Previous experiments with this crop have shown that larger crops of tomatoes, normal in size, color, taste, and chemical composition, could be grown in a soil of coal ashes and peat moss by the aid of commercial fertilizers than in a rich compost with or without commercial fertilizers. Experiments in 1898 showed that 28 oz. of nitrogen, 6 of phosphoric acid, and 21 of potash applied to each 100 sq. ft. of bench space of coal ashes and peat moss was excessive and injured the plant. Lorillard proved superior to either Acme or Essex Hybrid for forcing.

In 1899 soils of compost and of coal ashes and peat were placed in alternate plats throughout the forcing house and 2 crops of Lorillard tomatoes grown. Three plats were filled with compost which had been "sterilized" by heating 1 hour with steam. Nitrogen was furnished to the different plats in the form of nitrate of soda, cotton-seed meal, and fine bone, respectively.

"There was practically no difference in the average yields from plats dressed with nitrogen in nitrate of soda, cotton-seed meal, or ground bone. The yield from plats dressed with bone was slightly below the others. The soil of coal ashes and peat on the average yielded more tomatoes than the compost.

"Sterilizing the compost by heating for 1 hour with steam caused it to produce a heavier growth of plant and a smaller yield of fruit. A poor subsoil which was used in the benches, whether fertilized with chemicals or not, produced only about $\frac{1}{3}$ as much weight of tomatoes as the compost. Sutton Best of All gave a slightly larger yield than Lorillard as well as fewer and heavier fruits per plant. It was somewhat later in blossoming and maturing fruit. It does not appear to be greatly superior to Lorillard as a forcing variety."

The pollination of tomatoes in this experiment was secured by hold-

ing a spoon or ladle under each blossom and tapping the flower lightly from above. The jarring of the flower shakes the pollen into the spoon and brings the stigma into contact with it, pollination thus being secured. A new method was tested in 1899. The corolla of the flower was pulled away after it had fully opened.

[In doing this] "the anthers are broken open and the pollen, if ripe and dry, escapes into the air and some usually reaches the pistil of the flower and fertilizes it. . . . Blossoms pollinated in this manner produced as many fruits as where the spoon method was used. . . . The spoon method, however, took less time and it seems more likely to effect cross-fertilization."

Lettuce (pp. 224–226).—Results obtained subsequent to 1896 have been reported (E. S. R., 8, p. 405). The plats in the forcing house were $5\frac{3}{4}$ in. deep and contained 14.5 sq. ft. of surface each. Ten plats were filled with a rich compost of rotted turf and horse manure, and 10 with coal ashes sifted through a sieve with 4 meshes to the inch. The coal ashes were mixed with 5 per cent peat moss passed through the same sieve. During the season 3 crops of White Tennis Ball lettuce were grown on each of the plats. The yield of lettuce was smaller on sub-watered than on surface-watered plats with both kinds of soil. With the mixture of coal ashes and peat moss, applications of 162.9 gm. of nitrate of soda, 49 gm. of dissolved boneblack, and 88.8 gm. of muriate of potash gave as good results as larger amounts of these ingredients.

"The yield from plats of coal ashes alone was decidedly less than from the mixture of ashes and peat moss. From the compost soils to which only small quantities of nitrate were added no larger yields were got than from the corresponding ashes and peat plats, but when to the compost were added the same amounts of fertilizers as to the ashes and peat, the yields were larger from the compost. In all cases more marketable heads were got from the compost plats."

The following year mixtures of from 9 to 12 per cent of peat moss with coal ashes proved a better soil medium for lettuce than mixtures containing less than these amounts. In soil containing 12 per cent of peat moss, 1,000 plants, roots and heads, removed 443 gm. of nitrogen, equivalent to $6\frac{1}{2}$ lbs. of nitrate of soda; 185 gm. of phosphoric acid, equivalent to 3 lbs. of dissolved boneblack, and 697 gm. of potash, equivalent to $3\frac{1}{16}$ lbs. of muriate of potash.

In 1898 a black swamp muck of the neighborhood, which contained no fiber, proved inferior to peat moss as a soil medium for lettuce.

"A number of comparisons were made of the growth of lettuce on rich compost and of its growth on the same kind of compost which had been sterilized by heating it for 1 hour with live steam, which raises the temperature of the soil to above 100° C. . . . In every case a better crop was grown on sterilized soil than on the corresponding plats untreated. Lettuce transplanted only once was much larger and heavier than that which was twice transplanted. Fertilizer chemicals depressed the yield in each case, while the addition of lime did not greatly affect the weight or quality of the crop."

Carnations (pp. 226–235).—For a previous report see E. S. R., 10, p. 245.

"In the season of 1897–98 the largest number of blooms per plant was produced on rich compost to which nitrate of soda, dissolved boneblack, and muriate of potash had been applied at the rate of 620 gm., 154 gm., and 422 gm., respectively, per 100 sq. ft. of bench space, while the compost without fertilizers gave a slightly smaller yield of blooms than the soils made of coal ashes with 3 per cent of peat, to which were added 1,240 gm. of nitrate of soda, 462 gm. of dissolved boneblack, and 844 gm. of muriate of potash per 100 sq. ft. of bench space."

In 1899, 7 carnation plats were filled with a mixture of 184 lbs. of bituminous coal ashes and 5½ lbs. of peat moss, 3 with compost, and 2 with compost sterilized by heating for 60 minutes in steam. All the plats filled with ashes and peat and one of the compost plats were fertilized with various amounts of nitrogen in the form of nitrate of soda, cotton-seed meal, or bone dust, phosphoric acid in the form of dissolved boneblack, and potash in the form of muriate. The varieties Day Break, Thomas Cartledge, and Lizzie McGowan were used in the test.

"The 4 plats which contained the mixture of coal ashes, peat, and commercial fertilizers yielded a larger number of blooms, a greater weight of blooms, and blooms of somewhat larger size, on the average, than the 2 plats which contained rich unsterilized compost.

"Plat 183, of sterilized compost, yielded more blooms than any other in the experiment, though the average weight of blooms was not as great as of those grown in the coal ashes and peat moss. The other plat of sterilized soil, No. 185, gave a very small yield. We believe this is explained by the fact that, through an oversight of the attendant, it was omitted in the watering on a bright day and the plants were badly wilted. This plat yielded less than any other.

"The comparison of the different forms of nitrogenous fertilizer indicates that fairly good results may be obtained with either nitrate of soda, cotton-seed meal, or bone. Plat 178, to which bone was added, yielded a larger number of blooms than any other. The blooms on the average were not larger than those from plats where nitrate or cotton-seed meal was used. The nitrate plats produced blossoms having a greater average weight, diameter, and length of stem than those from plats where other forms of nitrogen were used."

Representative blooms from different plats were analyzed, and from the results the amounts of fertilizing materials removed were calculated.

Tomatoes, F. S. EARLE (*Alabama College Sta. Bul. 108, pp. 36, figs. 2*).—The author purposes to give in this bulletin an outline of the methods employed by the best commercial tomato growers in the latitude of the station. The topics discussed include soils and fertilizers, plant growing, cultivation and training, pruning, diseases and insects, varieties, and marketing Some results obtained in tomato growing at the station are included under the different headings. The diseases are noted elsewhere.

An account is given of growing Irish potatoes, peppers, eggplants, and tomatoes on plats fertilized alike as regards acid phosphate and cotton-seed meal. Two of the plats received in addition kainit at the rate of 1,500 lbs. per acre, 2 lime at the same rate, 2 were used as checks, and 2 others had Bordeaux mixture poured along the furrows.

The object of the experiment was to prevent the bacterial wilt. This was not present, but the Sclerotium wilt, black rot, and Alternaria leaf blight were more or less prevalent. The effects of the different treatments are noted in some detail. The Bordeaux mixture largely prevented the Alternaria leaf blight. The Sclerotium wilt was especially abundant on the potatoes where kainit had been used, a decreased yield of 60 per cent occurring on these plats. Tomatoes on the kainit plats were remarkably healthy, and their longevity considerably prolonged.

Lemon Blush has been one of the most satisfactory varieties of tomatoes grown at the station for midsummer and fall crops, and is recommended for home use. In planting for the market it is recommended that 4 or 5 of the best kinds of tomatoes be planted rather than to rely on any one variety alone.

Watermelons and muskmelons in South Dakota, N. E. HANSEN and W. S. THORNBER (*South Dakota Sta. Bul. 67, pp. 55–102, pls. 7*).—Results are here reported in tables and descriptive notes of tests of a large number of varieties of foreign and American watermelons and muskmelons during the years 1898 and 1899. Most of the foreign melons were of Russian and Asia Minor origin. The results of the tests show that the American muskmelons are much better adapted to the locality of the station than any of the foreign varieties tested. The smaller varieties proved earlier than the larger ones and are therefore preferred for localities where the growing season is short. From the standpoint of productiveness and quality Jenny Lind was the best variety grown. Larger earlier sorts were Earliest Ripe, Extra Early Citron, and Nectar of Angels. Other smaller varieties which were both productive and of excellent quality as well as early are as follows: Emerald Gem, Prolific Nutmeg, Newport, Rockyford, Burpee Netted Gem, Round Netted Gem, and Shipper Delight. Large varieties which were both productive and of excellent quality but late were Early Bristol, N. K. and Co. California Cream, and Chicago Market.

Of the 52 foreign watermelons tested, only 1 was found superior in earliness to the 106 American varieties grown. From the earliest watermelon of this variety pure seed was selected and sown. By continued selection it is hoped to increase the earliness of this variety. American varieties ripe September 6 were Light Green Rind Icing, Pride of Georgia, Russian Mennonite No. 7, Peerless, U. S. Dept. Agr. No. 23, Salzer Fourth of July, and Phinney Early Oval. Varieties ripe September 13 were Vick Early, Ruby Gold, Green and Gold, Phinney Improved, U. S. Dept. Agr. Nos. 72, 18, 92, and 88, Mountain Sweet, Black Diamond, Fordhook Early, Wisconsin Hybrid, Extra Early, and Jones.

A few varieties of citrons were grown as well as the orange melon and vegetable pomegranate. Suggestions regarding the preparation and use of the latter are given.

The apple orchard, J. C. WHITTEN (*Missouri Sta. Bul. 49, pp. 21, figs. 6*).—For the past 5 years, experimental orchard work has been under way at the station along several lines.

Previous preparation of the soil (pp. 3–7).—In 1895 young apple trees were planted on old, well-tilled heavy clay loam. Before planting, half the orchard was plowed deep and subsoiled while the other half was simply plowed deep. Subsequent cultivation was the same on both halves. No difference was noticed in the growth of the trees on the two portions of the orchard or in the subsequent condition of the land, and the amount of washing seemed to be about the same on both halves. The author states that while subsoiling may be beneficial on some soils, on soils similar to those noted only deep thorough plowing is necessary.

A young orchard was planted on newly cleared timber land. The location was a steep rocky bluff. Strips 6 or 7 ft. wide were plowed for the trees. The remainder of the land was left undisturbed to prevent washing. The trees planted on the land thus prepared made an excellent growth; the apple roots followed the decaying timber roots down among the rocks and the natural woods' mold and the sprouts which were left to decay formed an excellent mulch to prevent the soil from washing. The author considers this land, which is too rocky and steep for ordinary cultivation, an ideal place for an orchard. It requires much less cultivation than land that has long been tilled and thoroughly subdued. In clearing such lands for orchards, the author advocates the cutting of the trees as near the ground as possible to facilitate cultivation.

When orchards are planted on the hard-pan lands of the State, the hard pan may be loosened by exploding a small charge of dynamite in the bottom of each tree hole. This method, however, is expensive. It is recommended, therefore, to prepare the soil by previous cropping with clover or cowpeas.

The relation of cultivation to the development and growth of apple trees (pp. 7–15).—This subject has been studied for a period of 5 years. "Measurements have been taken of the average annual growth of trees receiving good cultivation, of those receiving partial cultivation, of those in clover and some in blue grass sod. In taking these measurements, a strenuous effort has been made to truly represent the average growth of trees under these various conditions of culture. Measurements have been confined to the leading branches of normal trees. Where trees have suffered from blight, accident, or other conditions unusual to other trees in the same orchard, they have been

rejected. Wherever pruning has abnormally affected the growth, such trees have not been considered. Measurements were made of all the leading branches on about 600 trees, through four seasons' growth." The observations have been made on Ben Davis, Jonathan, Jenet, and miscellaneous varieties of apples. The rainfall for the growing season of each of the years 1894 to 1898 inclusive is also given. Tabular results of the measurements show that the greatest growth has been made by those orchards that have been cultivated most, and that "cultivated trees make a more uniform growth than trees not cultivated." The more the trees are cultivated the less they are affected by drought. This is considered the most important point in the cultivation of orchard fruits in Missouri.

"The unfavorable effects of drought on uncultivated trees are more apparent the succeeding season than they are during the dry year itself. A marked falling off in height growth, and a generally devitalized condition of the trees, may be looked for, in uncultivated orchards, for a year or two following an excessive autumn drought.

"During 1898 more trees died as a result of the previous dry autumn than died during 1897. The unfavorable effects of this drought are yet (1899) apparent in uncultivated orchards." . . .

"During a dry summer and autumn, the orchard soil should be kept in good tilth until the crop of fruit and the wood growth are mature, or until rains come.

"During a wet summer and autumn, cultivation should cease early enough (August first) for the growth to be checked and the wood ripened for winter.

"Failure of the wood to mature in autumn may be as often due to ceasing cultivation too early as it is to continuing cultivation too late. This is particularly true when trees are loaded with fruit."

Crops to be grown in orchards (pp. 15–19).—The value of small fruits, garden vegetables, cowpeas, soja beans, clover, rye, and buckwheat is discussed. It is stated that nothing should be grown in the orchard which will prevent the cultivation of the tree rows. On steep hillsides clover is considered an especially desirable crop to grow to prevent washing. It should be sown in strips running across the hillsides between the rows and the trees given clean cultivation until they are well established.

Cultural methods—implements (pp. 20, 21).—The value of different cultural methods in the orchard is considered. Relative to the culture of other orchard fruits the author states that peaches should be given the same attention as apples.

"Standard pears and cherries usually succeed best if the land is cultivated until they reach bearing age, and then seeded to clover. Dwarf pears should be given the best of cultivation. Plums do best under clean cultivation, but the Americans will succeed fairly well in clover or even in blue-grass pasture. Japanese plums should be treated about the same as the peach."

A chemical study of the apple and its products, C. A. Browne, Jr. (*Pennsylvania Dept. Agr. Bul. 58, pp. 46; Rpt. 1899, pp. 534–572*).—The following analyses of 25 varieties of apples represent only sound, ripe fruit which, except the summer apples, had been stored in

a cool cellar from 1 to 2 months after picking, to insure the conversion of the residual starch into sugar:

Composition of the apple.

Variety.	Season.	Number of apples.	Water.	Solids.	Invert sugar.	Sucrose	Total sugar.	Total sugar after inversion.	Free malic acid.	Ash.	Sugar coefficient.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Red Astrachan	Summer.	10	84.70	15.30	6.67	3.53	10.20	10.38	1.11	0.37	67.84
Early Harvest	....do....	10	83.82	16.18	7.24	3.84	11.08	11.28	.87	.31	69.72
Yellow Transparent	....do....	4	86.17	13.83	7.84	2.05	9.89	9.94	.84	.27	71.87
Early Strawberry	....do....	10	84.42	15.58	5.34	4.11	9.45	9.66	.76	.28	62.00
Sweet Bough	....do....	6	85.18	14.82	7.51	2.98	10.49	10.64	.10	......	71.79
Butter-sweet	Autumn.	6	85.70	14.30	7.97	3.62	11.59	11.78	.38	.19	82.38
Fall Rambo	....do....	6	83.86	16.14	6.60	4.92	11.52	11.78	.61	.25	72.99
Baldwin	Winter ..	6	80.36	19.64	7.70	6.81	14.51	14.87	.65	.27	75.71
King	....do....	3	84.30	15.70	7.94	3.87	11.81	12.01	.48	.27	76.50
Golden Russet	....do....	10	76.64	23.36	11.75	4.79	16.54	16.79	.70	.32	71.87
Greening	....do....	6	83.20	16.80	7.11	5.27	12.38	12.66	.68	.26	75.36
Ben Davis	....do....	6	85.04	14.96	6.90	3.59	10.49	10.68	.55	.26	71.39
Northern Spy	....do....	4	82.43	17.57	8.92	4.29	13.21	13.44	.67	.33	76.49
Do	....do....	3	82.94	17.06	9.44	3.25	12.69	12.86	.53	.24	75.38
Spitzenburgh	....do....	3	80.02	19.98	8.92	5.75	14.67	14.98	.86	.29	74.98
Do	....do....	3	82.54	17.45	8.19	5.06	13.25	13.52	.62	.30	77.48
Twenty Ounce	....do....	2	86.54	13.46	7.27	2.60	9.87	10.01	.45	.17	74.19
Jonathan	....do....	8	85.28	14.72	7.40	3.63	11.03	11.22	.52	.22	76.22
Canada Reinette	....do....	6	85.62	14.38	6.60	3.74	10.34	10.54	.51	.24	73.29
Rambo	....do....	8	84.30	15.70	10.32	1.74	12.06	12.15	.36	.23	77.39
Newtown Pippin	....do....	6	82.39	17.61	6.36	6.13	12.49	12.81	.80	.27	72.74
Ewalt	....do....	6	84.36	15.64	8.13	2.64	10.77	10.91	.99	.26	69.76
York Imperial	....do....	6	82.90	17.10	8.65	4.33	12.98	13.21	.46	.22	77.25
Fallawater (Tulpahocken)	....do....	6	84.69	15.31	8.51	3.08	11.59	11.75	.32	.22	76.75
Yellow Bellflower	....do....	6	81.68	18.32	8.43	4.65	13.08	13.32	.74	.34	72.71
Sweet Vandevere	....do....	6	82.25	17.75	8.81	3.85	12.66	12.86	.26	.30	72.45
Bedford Red	....do....	4	84.96	15.04	7.40	3.50	10.90	11.08	.66	.28	73.67
Average of all			83.57	16.43	7.92	3.99	11.91	12.12	.61	.27	73.76

The following table gives the results of the analysis of the ash of the apple:

Composition of the ash of apple.

Constituents.	Per cent.	Constituents.	Per cent.
Potassium carbonate (K_2CO_3)	67.85	Magnesium oxid (MgO)	0.59
Potassium phosphate (K_3PO_4)	14.55	Ferric oxid (Fe_2O_3)	.95
Sodium chlorid ($NaCl$)	.60	Aluminum oxid (Al_2O_3)	.80
Calcium sulphate ($CaSO_4$)	4.52	Silica (SiO_2)	.40
Calcium oxid (CaO)	2.57		
Magnesium phosphate ($Mg_3P_2O_8$)	6.97	Total	99.80

"While the above analysis shows that the ashes of apples contain a considerable quantity of carbonate of potassium and a small amount of the oxids of calcium and magnesium, the statement should be made that these compounds do not exist in the fruit itself, inasmuch as the reaction of the latter is uniformly acid. The various bases which appear in the above analysis as oxids and carbonates exist in the apple, for the most part, in combination with malic acid as malates."

The chemistry of the growth of the apple is discussed, and the following table is appended, showing the analysis of the Baldwin apple at different periods of growth:

Composition of a Baldwin apple at different periods of growth.

Date.	Condition.	Water.	Solids.	Invert sugar.	Sucrose.	Total sugar.	Total sugar after inversion.	Starch	Free malic acid.	Ash.	Sugar coefficient.
1899.		*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Aug. 7	Very green	81.53	18.47	6.40	1.63	8.03	8.11	4.14	1.14	0.27	47.16
Sept. 13	Green	79.81	20.19	6.46	4.05	10.51	10.72	3.67	....	....	53.10
Nov. 15	Ripe	80.36	19.64	7.70	6.81	14.51	14.87	.17	.65	.27	75.71
Dec. 15	Overripe	80.30	19.70	8.81	5.26	14.07	14.35	....	.48	.28	72.84

For a guide in afterripening and storing, the author advises following the rules laid down by Thomas, which are, in effect, to keep a uniform temperature as near the freezing point as practicable and exclude air currents and bad odors.

The first result of afterripening is the conversion of the residual starch of the apple into sugar, at the conclusion of which the apple may be said to be chemically ripe. The sugar content is now at its highest. A table shows the later changes taking place in the Sweet Vandevere apple in afterripening.

The most notable change is the inversion of the sucrose.

The depletion of the soil by removing a crop of apples and the amounts of fertilizing ingredients stored up in the trees are discussed.

Under the head of apple products, a number of original analyses are presented, and the author discusses the disposal of the large residuum of unmarketable fruit. Attention is called to the importance of the evaporating industry. A table of best varieties for evaporating is listed, methods outlined, and the chemical composition of product given. A popular treatise is given on cider making, together with directions for the proper fermentation and racking. European and American methods are compared and tables shown of fermented and unfermented juices. The manufacture of cider jelly and its chemical composition are described. An analysis of adulterated apple jelly is presented and attention called to the amount of fictitious fruit jellies on the market. Glucose is the most common adulterant.

The method of making and the chemical composition of apple butter is treated. Attention is called to the danger arising from boiling this product in copper or brass kettles.

In the discussion of apple pomace, the author calls attention to the low value of this product as fuel, fertilizer, or food. It has some value in each of the above uses, but it is far more profitable to add small amounts of water to it and repress, using the juice obtained for jelly or vinegar. The chemical composition of first and second pressings is tabulated.

An outline is given of the manufacture of vinegar both by the slow and the quick fermentation processes. The product of the latter process is apt to be more uniform, though the former possesses the finer flavor and aroma. Tables of analyses are presented of pure cider vinegar completely and incompletely fermented. The latter contains alcohol. The adulteration of vinegars is shown, with tables of analyses of the same. The most common adulterants are caramel, molasses, sugar, glucose, and cider jelly. The presence of adulterants can usually be determined by polarized light. The methods of analysis are explained and the results amplified by tables.

Plums—a comparison of varieties, W. J. GREEN (*Ohio Sta. Bul. 113, pp. 151–163, figs. 13*).—The station plum orchard was started in 1893. Up to the present time about 175 varieties have been planted and nearly one-half of these bore fruit in 1899. The different varieties are classified into groups, the characteristics of the groups noted, and the varieties under each group which have been grown at the station are characterized. Native plums are divided into several groups. It is said of them that as a whole they are less injured by the curculio, are not so liable to rot, and are hardier than the European varieties. They are infertile when planted alone, and where a few varieties are planted care should be taken to select varieties which bloom at about the same time in order to insure fertilization of the blossoms. The following are considered the best varieties among the several groups: *Americana group*—American Eagle, Champion, Hawkeye, Illinois, Ironclad, Louisa, Rollingstone, and Weaver. *Miner group*—Forest Rose, Miner, Prairie Flower. *Wild Goose group*—Choptank, Milton, Poole Pride, Wild Goose, Whitaker. *Wayland group*—Golden Beauty, Reed, Sucker State, Wayland, Moreman. *Chickasaw group*—Newman, Pottawattamie, Yellow Transparent. *Triflora group, or Japanese plums*—Abundance, Chabot, Burbank, Ogon, Red June. *Domestica group*—Arch Duke, Bradshaw, Coe, Golden Drop, Grand Duke, German Prune, Gueii, Imperial Gage, Lincoln, Prince of Wales, Reine Claude de Bavay, Yellow Egg. *Hybrid plum*—Gold and Juicy.

An observation of the effects of nitrogenous fertilizers on California privet, W. E. BRITTON (*Connecticut State Sta. Rpt. 1899, pt. 3, pp. 217, 218, fig. 1*).—In connection with the propagation of California privet (*Ligustrum ovalifolium*) for use as a hedge, observations were made on the effect of nitrogen in the form of nitrate, cotton-seed meal, and ground bone. The privet was grown in 5-in. pots of sandy soil, practically free from humus, to which 1 gm. of carbonate of lime, 0.8 gm. of dissolved boneblack, and 0.4 gm. of muriate of potash were added. To a part of the pots 0.2 gm. of nitrogen was used in the form of sodium nitrate, cotton-seed meal, or fine, hard, raw bone. Others received no nitrogen. "The plants in soil to which nitrate had been added were much larger than any others and the foilage was of a darker

green color. Those in soil to which cotton-seed meal was applied made only a fair growth, while the effect of the bone fertilizer was scarcely apparent." At the end of the experiment the check plants measured from 7 to 10 in. high; plants fertilized with nitrate of soda, 24 to 30 in. high; with cotton-seed meal, 15 to 16 in. high, and with fine raw bone, 9 to 10 in. high.

Note regarding the effect of the winter upon chestnut grafts and scions, W. E. BRITTON (*Connecticut State Sta. Rpt. 1899, pt. 3, p. 239*).—Chestnuts grafted at the station in 1898 (E. S. R., 11, p. 742) were examined during the summer of 1899. The early set scions that had made the largest growth were found to be least injured by the winter. Scions set later than June 15 were all dead.

"One scion set May 6, which made a growth of over 6 ft. in 1898, lived through the winter and made a total growth of over 21 ft. in 1899. Others set the same day and which grew well in 1898, also made a good growth in 1899 and were then killed, presumably by the extreme drought which prevailed through the latter part of the season. So that with the combined effect of winter and drought, the percentages of scions set in 1898 and now alive is very small."

The scions set in 1899, although apparently healthy, appeared to have been injured by the winter. Others started and were killed by drought. But few were alive at the end of the season.

The report of the horticulturist, L. C. CORBETT (*West Virginia Sta. Rpt. 1899, pp. 36–45, figs. 5*).—An outline is given of the work of this department in hand and of that contemplated. A detailed account, with illustrations, is given of an improved auxanometer and a transpiration apparatus, with some explanations as to the uses of these instruments in studies of plant physiology.

The cultivation of horse radish (*Queensland Agr. Jour., 7 (1900), No. 3, p. 233*).—Methods of culture observed in Bohemia are given.

Canning corn and vegetables, R. H. PRICE (*Farm and Ranch, 19 (1900), No. 42, pp. 10, 11*).—Some of the advantages of running a cannery in connection with truck gardening operations in Texas are noted and data given showing the cost involved.

The propagation of high-grade fruit, G. E. POWELL (*Ontario Fruit Grower's Assoc. Rpt. 1899, pp. 32–47*).—A popular article dealing especially with the propagation of the apple and the use of crimson clover as a cover crop for the apple orchard.

Observations on the fertilization of peach orchards, E. H. JENKINS (*Connecticut State Sta. Rpt. 1899, pt. 3, pp. 283–285*).—A report of progress on experiments in fertilizing Mountain Rose, Champion, and Early Rivers peaches with ashes and different amounts of muriate, and sulphate of potash, and cotton-seed meal. The orchard was set in 1894 and a crop of peaches was secured in 1899. The yields secured from the different plats are reported as a matter of record. No conclusions are drawn.

Distribution of sugar, acid, and tannin in pears, W. KELHOFER (*Jahresber. Wädensweil, 6, p. 68; abs. in Jour. Chem. Soc.* [*London*], *78 (1900), No. 453, II, p. 497*).—Determinations of these constituents in the skin, fruit, core, and whole pear are reported. The amounts found in the whole pear were as follows: Sugar, 8 per cent; acid, 12.61; tannin, 2.05.

Prune curing in France (*California Fruit Grower, 25 (1900), No. 632, p. 1*).—The process of curing in vogue at Agen is described.

Drying fruit, HELD (*Württemberg. Wchnbl. Landw., 1900, No. 31, p. 504*).—Brief directions for preparing and drying apples, pears, quinces, and cherries.

Length of canning season, H. Dyer (*Pacific Rural Press, 60 (1900), No. 4, p. 52*).—A table is given showing the duration of the fruit-canning season in California for 37 consecutive years for fruits and vegetables. The whole season extends from April 6 to December 1.

Commerce in large fruits, J. W. Robertson (*Ontario Fruit Growers' Assoc. Rpt. 1899, pp. 76–91*).—A popular discussion of the shipment of apples from Canadian ports, together with statements of dealers and others regarding the requirements of foreign markets.

Grafting the mango tree, H. Knight (*Queensland Agr. Jour., 7 (1900), Nos. 1, pp. 41, 42, pls. 2; 2, pp. 149–151*).—The author states that this fruit can be easily and successfully grafted at any time whether the sap is active or dormant. The first three months of the growing season, however, when the sap is most active, is preferred. Pieces of bark without any portions of adhering wood are recommended for use as grafts. Sections of the mango tree, it is said, will keep good for grafting purposes from 3 to 6 months, depending upon the variety and constitutional vigor of the specimen. Directions for grafting mangoes and illustrations of grafts are given.

Pruning the magnolia, S. Mottet (*Rev. Hort., 72 (1900), No. 17, pp. 490, 491*).—All the principal branches of *Magnolia aborata lenei* were severely headed in before the flowers opened in the spring. As a result scarcely any flowers were produced that year, but the following spring an unusually abundant florification took place.

FORESTRY.

Forest trees and shrubs, A. Mackay (*Canada Expt. Farms Rpts. 1899, pp. 372–376*).—A report is given on the forest trees and shrubs under observation at the Northwest Territory Farm. Since 1895 investigations have been conducted on the cost of planting and cultivating forest trees. This test is closed with this report, as the trees now cover the ground so that no further cultivation will be given. It was found that the cost of planting and cultivation of box elders set at different distances from 2½ to 4 ft. varied from $6.55 to $7.60 per half acre. For green ash set 2½ ft. apart each way, the cost was $7.61. When the seed was sown directly in the ground the cost was somewhat greater than when the trees were started in a nursery and afterwards transplanted.

The arboretum is said to contain at the present time 371 species and varieties of trees and shrubs, a considerable portion of which, it is believed, will prove hardy in this climate. A list is given of 10 forest trees suitable for the Northwest Territories. The species recommended are box elder, American cottonwood, Balm of Gilead, American larch, American elm, green ash, sharp-leaved willow, trembling-leaved poplar, Riga pine, and Norway spruce. Each of these trees is described briefly and its relative value for different purposes indicated.

Importance of forest tree growing, D. C. Burson (*Forester, 6 (1900), No. 3, pp. 57, 58*).—Extracts are given of a paper read by the author, in which some of the more important uses of timber are mentioned. The rapidity with which the forests are disappearing and the vast extent of wood-working industries are said to attract immediate attention to the financial side of forest tree growing. It is stated that

10,000,000 acres of forests are denuded annually, and these should be replanted in order to preserve the equilibrium. By the proper selection of soil, choice of trees, care in planting and cultivating, it is believed that this could be successfully done.

The forestal conditions and silvicultural prospects of the coastal plain of New Jersey, J. GIFFORD (*Rpt. State Geol. New Jersey, 1899, pp. 235–318, pls. 16*).—The coastal plain of New Jersey is said to embrace about 2,500 square miles, 75 per cent of which is wooded. It is slightly rolling, seldom exceeding 200 ft. above sea level. Light sandy soils predominate, although there are many places where heavy clay and coarse gravel are found as well as clay loams and mucky swamp lands. The different species of trees found in this region are enumerated, their uses and distribution being described. Suggestions are given for forest policy to be adopted by the State as well as silvicultural methods. By selection of proper species, planting, and proper care in the prevention of forest fires, the author believes the region could be reforested so as to be of greater economic value than at present. Descriptive notes are given on a number of regions in Europe which are similar to southern New Jersey where reforestation has been successfully carried out.

Forest planting in Norway, DEINBOLL (*Forester, 6 (1900), No. 3, pp. 49–52*).—The former condition of the forests of Norway are described and their present character contrasted. It is stated that a large part of the country is almost barren of timber, so much having been cut away that one-half the country has not enough timber for building purposes and one-fourth not enough for fuel. The amounts cut each season are mentioned and the necessity for replanting is shown. The first artificial planting was begun in 1869 at Bergen, Norway. At the present time the government maintains six large and a number of smaller planting schools, which annually plant about two and a half million trees. The necessity for extending this work is shown and suggestions offered of possible means for the improvement of forest conditions.

Conifers at Murthly Castle, Scotland (*Garden, 57 (1900), No. 1487, pp. 358, 359, figs. 2*).—An account is given of the rate of growth and present condition of a number of species of coniferous plants which have been growing for nearly half a century on this estate. The results do not represent single individuals, but a large number of representatives of the different species. A number of the trees are said to have been severely injured by the cold weather of the winter of 1894–95, when for several days the temperature was below zero F. The results of some of the measurements as well as the ages of the trees are given in the following table:

Growth of conifers at Murthly Castle, Scotland, March 24, 1900.

Species.	Date of planting.	Height.	Circumference 5 feet high.	Species.	Date of planting.	Height.	Circumference 5 feet high.
		Feet.	*Feet.*			*Feet.*	*Feet.*
Sequoia gigantea	1857	74.11	10.7	*Cedrus deodar*	1842	61.2	7.4
Abies menziesi	1845	105.10	11.3	*Cedrus libana*		67.0	12.5
Pinus monticola	1850	79.2	6.2	*Cryptomeria japonica*	1852	41.7	4.3
Araucaria imbricata	1847	51.0	4.8	*Libocedrus decurrens*		38.0	4.5
Abies pinsapo	1847	42.6	7.10	*Thuja gigantea*	1862	57.0	3.7
Abies magnifica	1867	43.3	3.8	*Cupressus lawsoniana*	1859	48.7	4.2
Abies douglasi	1847	97.4	9.1	*Abies ajanensis*	1885	24.0	1.7
Abies grandis	1852	79.10	6.1	*Abies veitchi*	1885	20.9	1.4
Abies albertiana	1860	72.1	6.4	*Abies concolor*	1885	20.1	1.5
Abies nobilis	1847	92.8	6.6	*Abies orientalis*	1852	49.0	3.0
Abies nordmanniana	1854	74.0	4.9	*Pinus jeffreyi*		57.0	4.9
Abies hookeriana	1862	39.6	4.0	English yew		30.0	14.3

What the experimental farms have done to stimulate tree planting, W. SAUNDERS (*Canada Expt. Farms Rpts. 1899, pp. 42–45*).—Experimental forest tree planting was begun in 1888 and has been carried on at the Central Farm as well as a number of branch stations since that time. There are now growing on the 5 experimental farms a total of 245,000 trees. In addition there have been distributed from this station 1,261,000 forest trees and 14,000 lbs. of forest tree seeds. The results of this work are said to be everywhere apparent, small plantations of forest trees furnishing shelter for gardens, buildings, and stock, as well as making dwellings more attractive. Experiments have shown that the box elder is one of the most promising forest trees and, as it begins to produce seed when 6 or 7 years old, it is possible to reproduce this species quite rapidly.

Forest belts, W. T. MACOUN (*Canada Expt. Farms Rpts. 1899, pp. 117–123*).—In the Report for 1897 (E. S. R., 10, p. 855) the condition of the forest belts at that time was reviewed and measurements given of the trees at the Central Experimental Farm. In the present report additional measurements are given, this time the diameter of the trees at the height of 4 ft. 6 in. from the ground being recorded. Owing to unsuitability of soil and climate, the specimens of red maple, Norway maple, European mountain ash, buttonwood, horse chestnut, and Kentucky coffee tree have been removed. An account is given of the trees planted in forest belts in 1899, in which about 5,000 trees of 10 varieties were set out. The condition of the arboretum is outlined, together with brief notes on the additions to the arboretum and botanic garden.

Forest tree shelter belt, S. A. BEDFORD (*Canada Expt. Farms Repts. 1899, pp. 319–321*).—A report is given on the forest tree shelter belts which were planted at the Manitoba Farm in 1889. This shelter belt was composed principally of box elder, elm, ash, birch, cottonwood, poplar, spruce, pine, and arbor vitæ. The pines and spruces have been injured by the more rapid growing of the deciduous trees. For general planting of wind-breaks in Manitoba, the author recommends the use of box elder, elm, ash, and poplars. The box elders and poplars should be about 2 years old, and the elms and ash 4 years when planted, and should be set 4 ft. apart each way. Close planting will insure straighter and taller trees and sooner cover the ground, stopping evaporation and preventing the growth of weeds.

Notes are given on a new plantation which was set out in the spring of 1898 of maples, ash, and sand cherry. The additions to the arboretum of new trees and shrubs are mentioned and notes given on the value of different species for constructing hedges.

Some observations of Ohio woodlands, J. E. CUNNINGHAM (*Forester, 6 (1900), No. 5, pp. 103, 104*).—The past and present condition of Ohio forests is reviewed,

and it is stated that in 1896 17.4 per cent of the lands which had been previously well forested remained in timber. Certain regions are almost entirely denuded and it is suggested that efforts should be made to maintain at least 15 per cent of the area permanently in forests.

Forest conditions of Cuba, J. GIFFORD (*Forester, 6 (1900), No. 5, pp. 97–100, pl. 1, fig. 1*).—A brief survey of the forest conditions of Cuba, as observed by the author in crossing the island, is given. Even in the mountainous districts the forests are said to be sparse and thin. It is said to be a common practice to burn over uncultivated lands for the improvement of pasturage. A number of the more common forest trees occurring in Cuba are described and suggestions given for future plantings.

Silvicultural prospects of the island of Cuba, J. GIFFORD (*Forester, 6 (1900), No. 8, pp. 177–183, pl. 1, fig. 1*).—Attention is called in this paper to the great advantages of this region in the production of wood and other forest products. The necessity for a botanic garden or experiment station in this region is also shown.

Forestry in western Australia, J. FOLEY (*Forester, 6 (1900), No. 3, pp. 59, 60*).—The forest conditions of western Australia are briefly reviewed and contrasted with the same in this country. Attention is called to some of the more important forest trees of the region, 3 species of Eucalyptus being described, and also the sandalwood tree. It is believed that the conditions would be found favorable for the introduction of some of the American species of maple, hickory, pine, fir, black walnut, catalpa, and white oak.

Reforestation of Campine, L. NÉVE (*Bul. Soc. Cent. Forst. Belg., 7 (1900), No. 5, pp. 382–394*).—Suggestions are given for the clearing and reforestation of this district. Working plans are suggested, in which the cost of reforestation and the returns to be expected are shown. It is claimed that this region may be reforested with *Pinus sylvestris* and at the end of the twentieth or thirtieth year it should produce a revenue of about 7 per cent. The author believes that the average revenue in no case would fall below 4 or 5 per cent, and the advantages to agriculture would warrant the reclamation of this region.

Shrubs and trees, W. S. BLAIR (*Canada Expt. Farms Rpts. 1899, pp. 260, 261*).—Lists are given with brief notes of some 70 species of hardy shrubs and coniferous trees growing at the Maritime Experimental Farm.

Notes on some coniferous trees of North America, N. I. CRAHAY (*Bul. Soc. Cent. Forst. Belg., 7 (1900), Nos. 3, pp. 163–176; 4, pp. 249–255; 5, pp. 340–351; 6, pp. 415–418; 7, pp. 493–499; 8, pp. 555–558, pls. 6*).—Notes are given on the distribution and extent of the coniferous forests of North America and some of their associate deciduous trees. In all, 140 species of trees are mentioned.

Descriptions are given, in which the distribution, habitat, principal characteristics of the trees, the quality of wood, and the uses of nearly all of the more common Coniferæ of North America are mentioned.

The conifers of Holland, B. STOFFEL (*Bul. Soc. Cent. Forst. Belg., 7 (1900), No. 4, pp. 290–294*).—Descriptive notes are given of a number of the conifers growing in Holland, the most important of which are *Picea excelsa*, *Pinus sylvestris*, *Abies pectinata*, *P. strobus*, and Oregon pine.

Notes upon the black locust, K. BUND (*Bul. Soc. Cent. Forst. Belg., 7 (1900), No. 1, pp. 22–27*).—Notes are given on the growth and forest value of *Robinia pseudacacia*. The soil requirements of this tree are shown and the plants which characterize such soils are mentioned. Methods are given for the planting of the black locust tree which in 25 years should attain a height of 20 meters and a diameter of from 0.1 to 0.2 meter. After the twentieth to the twenty-fifth year, the rate of growth is not so rapid. Directions are given for the planting and treatment of the locust tree in nurseries.

The white alder (*Bul. Soc. Cent. Forst. Belg., 7 (1900), No. 3, pp. 191–193*).—A description is given of this tree, which is believed would prove a valuable addition

to the forests of Belgium, especially in the coppice. Three distinct varieties are recognized, the one in which the leaves are greatly elongated and stems more erect being preferred to the others which are of lower or intermediate growth.

The paper industry and forests, C. W. LYMAN (*Forester, 6 (1900), No. 6, pp. 125–130*).—The different sources of paper are briefly indicated and descriptions given of some of the trees that are known to be of value as a source of wood pulp. The processes of pulp manufacture are briefly described, and it is said that in 1899 there were 197 mills in operation in 24 States, having an estimated daily capacity of 3,810 tons. The total consumption of timber for pulp manufacture is said to be about 800,000,000 ft. Large as this consumption appears, it is said to be but 0.4 of 1 per cent of that consumed for lumber and fuel.

Forest fires in 1899 (*Bul. Soc. Cent. Forst. Belg., 7 (1900), No. 1, pp. 61–63*).—During the season of 1899 the forest fires in Belgium burned over 373 hectares, causing a loss of 94,100 francs.

Unextinguished camp fires, C. S. CRANDALL (*Forester, 6 (1900), No. 3, pp. 65, 66*).—As a means for causing forest fires, the camp fire is discussed, and accounts are given of a number of forest fires which can be traced to this source and also of several forest fires which were probably prevented by the discovery and extinguishing by the author of fires that were beginning to spread from abandoned camps.

Forest laws in the United States, T. CLEVELAND, JR. (*Forester, 6 (1900), Nos. 7, pp. 153–160; 8, pp. 183–186; 9, pp. 210–212; 10, pp. 238–240*).—The forest laws of various States and of the Federal Government are briefly reviewed, together with the results obtained in the application of these laws. As a conclusion to the review of the various legal enactments, the author states that "the forest movement has acquired an impetus that can not be checked. That movement has found effective expression in State and Federal laws. These laws are laying the foundation for a perfect system of forest management, and forest management has already reached practical success."

SEEDS—WEEDS.

Influence of varying the temperature on the germination of seeds, W. KINZEL (*Landw. Vers. Stat., 54 (1900), No. 1–2, pp. 134–139*).—Seeds of conifers, grasses, lupines, buckwheat, and hemp were germinated under similar conditions except temperature. One lot was kept uniformly at 20° C., and the other at 30° for 6 hours, after which the temperature fell to 20°. The effect of this treatment upon the germinative energy and upon the total germinations is shown. The germination of *Pinus sylvestris* was lower in the lot which had been exposed to the higher temperature. With *Picea excelsa* and *Larix* sp. the germination was accelerated by the treatment, and in the case of the latter the total germination was a few per cent higher. In the case of the grasses the sprouting was diminished in the case of *Festuca ovina* and both germinative energy and total germinations increased with *Holcus lanatus* and *Anthoxanthum odoratum*. The germination of *Cynosurus cristatus* was accelerated, but the totals were greatest for the constant temperature. Contrary results were obtained with different lots of lupine seed, and the hemp and buckwheat seed kept constantly at 20° C. gave the best germinations.

Tests of the vitality of vegetable seeds, E. H. JENKINS (*Connecticut State Sta. Rpt. 1899, pt. 3, pp. 298–304*).—A report is given on

tests for vitality of 291 samples of seeds, chiefly of garden vegetables. Since November, 1896, 214 samples of onion seeds, representing the crops of 1896, 1897, 1898, and 1899, have been tested, the results showing that the vitality seems to depreciate with increased age. Comparisons are also made between Connecticut and California grown seed, from which it appears that the California seed sprouts better than the home-grown. Comparisons of the vitality of crops of Connecticut-grown onion seeds in the years 1894–1899 are summarized. The sprouting capacity of different varieties was again tested, with the result that the 3 Globe varieties appeared to be essentially alike, while the White Portugal was distinctly inferior to them.

Spraying for the destruction of mustard, F. T. Shutt (*Canada Expt. Farms Rpts. 1899, pp. 194–196*).—A number of experiments are reported in which different strengths of sulphate of iron and sulphate of copper were tested for the eradication of wild mustard or charlock. This weed has become one of the most persistent in Canada. The author sprayed barley plats with 5 and 10 per cent solutions of iron sulphate or 2 and 5 per cent solutions of copper sulphate, at the rate of 50 gal. per acre. At this time the grain was between 15 and 20 in. high and the mustard just coming into flower. The iron sulphate solutions were without lasting effect upon the mustard. The copper sulphate damaged the barley to some extent and the stronger solution it is thought lessened the yield slightly, but both strengths almost entirely destroyed the mustard plants present.

In order to ascertain the effect of these solutions upon this weed at younger stages of growth, mustard seed was sown on plats in the farm and when the plants were from 6 to 9 in. high were sprayed with the 5 per cent solution of iron sulphate and the 2 per cent solution of copper sulphate. The iron sulphate solution did not kill all the plants, while the copper sulphate destroyed all within a few days. From the data at hand the author feels warranted in making the following sugestions:

"A 2 per cent solution of sulphate of copper (that is, 2 lbs. in 10 gal. of water) is, all things considered, the most effective, safest (as regards the grain crop), and most economical to use. The spraying should be done thoroughly, and for that purpose 50 gal. per acre will be required. If a heavy rain follows the spraying within 24 hours the operation will have to be repeated. In order that the work may be effective, spraying should not be delayed after the mustard plants have reached a height of 6 to 9 in. If allowed to grow taller than this, stronger solutions would be necessary and in larger quantities, as the grain would then largely protect the mustard."

Results of experiments on the spraying of charlock, P. S. Foulkes (*Jour. Univ. Extension Col., Reading* [*England*], *Sup. 9, 1900, pp. 55–59*).—Experiments were conducted on crops of wheat, barley, and oats for the destruction of charlock. Applications of copper sulphate solutions of from 1 to 6 per cent at the rate of from 25 to 50 gal. per acre were employed. The applications were made at differ-

ent times and under varying climatic conditions. An almost total failure is reported from one series of experiments; elsewhere the effect of spraying was to retard the growth of the charlock. It is concluded from the experiments that if care is taken in the spraying and the application be made on a clear, still, bright day, spraying for charlock is undoubtedly an effective means for its destruction. The application should be made before the plants come into flower, and a 2 per cent solution at the rate of 50 gal. per acre gave the best results. If these conditions are complied with, one spraying should be sufficient to destroy the weeds. If the weather is unfavorable or if rain falls within 24 hours after spraying, a second application should be made.

Seeds and seed tests, C. T. MUSSON (*Agr. Gaz. New South Wales, 11 (1900), No. 10, pp. 856–862*).—An account is given of seed tests performed at Hawkesbury Agricultural College and the importance of seed testing is shown. The methods pursued are described and comparisons given between the standard germinations of a number of seeds and the percentages of germination obtained at this station.

Tests of the vitality of grain and other seed for 1899, W. T. ELLIS (*Canada Expt. Farms Rpts. 1899, pp. 38–40*).—A tabulated report is given of the results of seed tests for vitality made during the season, 2,058 samples of seed being tested, more than four-fifths of which were wheat, barley, oats, and peas. A report is also given showing the results of grain tests made for each of the 8 provinces of Canada.

Testing grass seed, C. D. WOODS (*Maine Sta. Bul. 65, pp. 112–114*).—Notes are given on 103 samples of clover and grass seed which were examined by the station during 1899. Tables are given showing the results of the separate analyses as well as the kinds of weed seed found in the different samples examined.

The worst weeds of the Northwest, J. FLETCHER (*Canada Expt. Farms Rpts. 1899, pp. 184–194, figs. 8*).—Lists are given of weeds of the Northwest Territories, they being divided into the worst weeds and occasional weeds. The plants in question are popularly described and, so far as known, remedies are suggested for their destruction. The following list of weeds are considered especially noxious and every effort should be put forth to destroy them when detected or prevent their introduction to new localities: Stink weed or penny cress, wild oat, Canada thistle, tumbling mustard, hare's ear mustard, false flax, ball mustard, wild mustard, shepherd's purse, lamb's quarters, wild buckwheat, Russian pigweed, cow cockle, great ragweed, Canada fleabane, blue bur, peppergrass, and squirrel-tail grass.

A brief description is given of weeders for use in extensive operations, and notes are given on the condition of the wheat crop relative to the occurrence of weeds and weed seeds. The crop of this season is said to have been exceedingly free from weed seeds.

Destruction of weeds by chemical means, O. LUGGAR (*Farm Students' Rev., 5 (1900), No. 11, pp. 163–165, fig. 1*).—A popular article on weed destruction by spraying with solutions of iron or copper sulphates.

DISEASES OF PLANTS.

Miscellaneous notes on fungus diseases, W. C. STURGIS (*Connecticut State Sta. Rpt. 1899, pt. 3, pp. 277–282*).—Notes are given on the downy mildew of melons, a destructive disease of potatoes, injury to peas, leaf spot of alfalfa, and a disease of peppers.

The downy mildew of melons (*Plasmopara cubensis*), while common upon cucumbers, has been previously reported but once as occurring upon muskmelons within the State. During August a number of specimens were sent to the author from vines which were badly infested with the disease, every leaf on a 2-acre field being dead. Investigation showed the fungus mentioned above. The same disease is liable to attack cucumbers, and spraying experiments for its prevention do not seem to have been conducted with uniform success. The use of Bordeaux mixture as a partial preventive, or forcing the melons and cucumbers by starting them earlier in the season and transplanting so that the fruits will be matured before the usual time for attacks of this mildew, are recommended.

The disease of potatoes described was characterized by the blackening and shriveling of the stalks which upon examination appeared to be hollowed from an inch or so below the surface to 2 to 8 in. above. The similarity in appearance between these hollow stalks and the injury caused by potato-stalk borers led to a careful search, but no insects were found. A microscopical examination showed neither fungus nor bacteria. Upon the author's recommendation, all diseased vines and those for a hill or two beyond the limit of the affected area were collected and burned, and no further trouble was experienced by the grower.

A serious injury to peas is described, which is caused by the leaf-spot fungus Ascochyta. There seems to be reason to believe that the fungus attack is not primarily above ground but that it may be present in the seed. Should the disease threaten serious injury in the future, it would be advisable to obtain seed from regions where it is not present, and to select land which has not borne peas for a number of years. In case it is necessary to use the same land for two or more successive crops, as soon as the crop is harvested, all vestige of vines should be gathered and burned.

A brief note is given on leaf spot of alfalfa (*Pseudopeziza medicaginis*). This disease has been fully described in the report of the Iowa Station for 1897 (E. S. R., 10, p. 263). If the disease appears early in the season, the alfalfa should be cut and fed immediately. If later in the season, one practical means of combating it is by continuous cropping, or watching for its appearance, which would generally be at a few points in the field, and cutting and burning the affected plants.

The disease of peppers described is that of anthracnose (*Colletotrichum nigrum*). This is reported to have occurred during the past summer in fields in which at least 25 per cent of the fruit was rendered worthless by the fungus. No experiments have been attempted for its prevention, but based on experiments conducted elsewhere it is thought that irrigation and mulching would prove advantageous.

A contribution to the knowledge of cereal rusts, H. KLEBAHN (*Ztschr. Pflanzenkrank., 10 (1900), No. 2, pp. 70–96, figs. 3*).—Investigations are reported on the occurence of rusts on wheat, barley, and rye, inoculation experiments with sporidia upon the teleutospore hosts, rust spores in the air, investigations on the alternate generations of rusts, wintering of rusts, effect of using seed from infected plants, and studies on the anatomy and biology of the yellow rusts.

The author's investigations led to the following conclusions: The sporidia of cereal rusts can not infect cereals, nor can the sporidia of any of the heterœcious rust fungi infect their teleutospore hosts. From carefully conducted experiments there seems little to substantiate the claim that rusts may be communicated by sowing seed from infected plants. Such cases may be usually traced to outbreaks of the disease in the early spring. The probable agency of winds and animals in transmitting rusts is recognized, and further investigations along this line are in progress. There appears to be too little attention paid to the æcidial phases of the rusts, and these should be known for every species. The brown rust of rye (*Puccinia dispersa*) has its æcidia upon *Anchusa arvensis* and *A. offinalis*, but not the wheat brown rust (*P. triticina*), nor *P. simplex*. The anatomical and biological investigation of *P. glumaris* showed some important specializations that require further study. There was no indication that any of the rust fungi, which were without a perennial mycelium, are able to infest their host plants the following growing season, the presence of disease being attributed to a new infection.

Parasites of wheat, L. MANGIN (*Overs. K. Danske Vidensk. Selsk. Forhandl., 1899, pp. 213–272, pls. 3, figs. 17; abs. in Jour. Roy. Micros. Soc. [London], 1900, No. 3, p. 366*).—In this paper the conditions of wheat attacked by *Septoria graminum* and *Leptosphæria herpotrichoides* are described. The spores of *S. graminum* put out germinating filaments which perforate the epidermis, never entering through the stomata, their action being purely chemical. The specific characters of the fungus are constant and its ascospore form is as yet unknown. The second disease, to which the name "piétin" is given, is caused by the Leptosphæria and is often accompanied by a number of other fungi, among them *Ophiobolus graminis*, *Pyrenophora trichostoma*, and *Aspergillus circinatus*, the latter being considered a new species. Cultures, according to the author, demonstrated that *Dictyosporium opacum* is the conidial form of *Leptosphæria herpotrichoides*.

On the so-called "grain" of wrapper tobacco, W. C. STURGIS (*Connecticut State Sta. Rpt. 1899, pt. 3, 262–264, pl. 1*).—It is stated that tobacco leaves used for wrappers frequently exhibit, after curing, numbers of minute, blister-like pimples thickly scattered over the surface of the leaf, giving it a somewhat granular appearance. This

"grain" occurs on all kinds of tobacco which have been examined. Microscopic examinations of the blisters show a dense deposit of crystalline substance which tests have shown to be oxalate of lime. This being the case, it might be supposed that the addition of lime to soil would make the "grain" in cured tobacco more prominent, but specimens taken from different plats showed that there was no relationship apparent between the amount of lime used as fertilizer and that occurring in the leaves. As to whether the "grain" is formed during the process of curing or is present in the growing leaves, nothing definite can be stated as yet. The author believes it probable that tobacco plants under certain conditions take up greater quantities of lime than they can utilize and deposit it in the tissues, and that it becomes visible only after the shrinkage in thickness incident to the process of curing.

Further notes on the pole burn of tobacco, W. C. Sturgis (*Connecticut State Sta. Rpt. 1899, pt. 3, pp. 265–269*).—In the Annual Report of the station for 1891 (E. S. R., 3, p. 773) the pole burn of tobacco was described at some length, and the isolation of a number of bacteria from the surface of leaves, as well as species of Cladosporium, noted. Recently leaves were collected which showed the beginnings of pole burn, the tissues along the larger veins being of a darker color and extremely tender. These areas were subjected to examination and 2 series of cultures maintained, one of which developed an Alternaria and a species of yeast, while the other, which had been sterilized, developed a bacillus. From a doubly sterilized leaf were developed in the course of 10 days a large colony of a bacillus of the type of *Bacillus subtilus*, and smaller colonies related to *B. megatherium*, and a few small colonies of Micrococcus.

The author concludes, as far as the organisms associated with the earliest stages of pole burn are concerned, that Alternaria is the only one which occurs in any abundance, and that it occurs only on the surface of the leaf and not in the internal tissues. The presence at this time of Alternaria and other organisms not found previously merely indicates that under certain atmospheric conditions any saprophytic fungus which may be present in the curing barn may attack the dead tissues of the leaves and start in them a process of disintegration, which will almost surely be followed by true bacterial decay.

The remedial measures recommended in the previous report are reaffirmed.

On fractional fertilization of muskmelons as a preventive of disease, W. C. Sturgis (*Connecticut State Sta. Rpt. 1899, pt. 3, pp. 270–273, dgm. 1*).—In the report of the station for 1898 (E. S. R., 11, p. 754) an account was given of favorable results attending the use of tobacco stems as a mulch for melon vines. An experiment was planned to test the effect of small applications of plant food from time to time

throughout the growing season for the prevention of the wilt disease. A fertilizer consisting of 4 parts of potash, 4 of nitrogen, and 1 of phosphoric acid was applied to hills of melons at different times during the growing season, with the result that such plants maintained their vigor, and on the fertilized plats there was no yellowing of vines or spotting of leaves.

The conclusion was reached that the diseases ordinarily present and abundant in other parts of the field were primarily due to a deficiency of available plant food, and that the indications of actual disease were merely incidental. The fact that where additional fertilizer was applied there was an almost complete absence of the wilt and spotting of the leaves is believed by the author sufficient to warrant further experiments along this line.

Notes on some tomato diseases, F. S. EARLE (*Alabama College Sta. Bul. 108, pp. 19–33*).—Notes are given on bacterial black rot, bacterial wilt, sclerotium wilt, leaf blights, and leaf mold or mildew.

The black rot or blossom end rot, as here described, is attributed to an undescribed species of Bacillus. This disease has been under investigation for a number of years, and a preliminary paper upon it was read by the author before the Botanical Club during the meeting of the American Association for the Advancement of Science in 1899. This paper is printed in full, from which it appears that this disease has been known for a long time. It has been usually attributed to attacks of fungi, the principal ones being *Macrosporium tomato* and *Fusarium solani*. It has been shown by the Vermont Station (E. S. R., 8, p. 992) that these fungi are unable to produce the disease. Tomatoes attacked by this disease show small, irregular, watery areas, usually at the blossom end. Investigations by the author have shown that this region is crowded with bacteria, which have been isolated, and inoculation experiments conducted by which the disease has been readily reduced. The bacillus is of medium size, stains readily, and as yet no spore formation has been detected. It grows readily on the flesh of sound green tomates, causing rot, but can not penetrate the cuticle unaided. It is strictly aerobic, developing only on the surface of culture media. It fails to grow on a number of other plants, such as the fruit of sweet peppers, onions, cabbage, kohl-rabi, etc. Summarizing his studies, the author concludes that the cause of the black rot, or blossom end rot, is a bacillus. The method of infection in nature has not been fully determined, but it is probable that it is through the agency of minute insects. The presence of species of thrips in considerable abundance suggested this insect as a possible agency in spreading the disease. When the bacillus is carried deeply into the tomato by an open wound, as is done by the bollworm, the result is a wet rot, quickly involving the entire fruit. In seeking a remedy for this disease, the author believes that insecticides, rather

than fungicides, should be tested. Experiments are planned by which the author hopes to demonstrate the agency of thrips in distributing the bacilli and in inducing the disease.

Experiments on the control of the bacterial wilt and the sclerotium wilt by means of culture and the use of fertilizers are reported elsewhere (p. 552).

Observations on tomato blight, C. E. MEAD (*New Mexico Sta. Bul. 33, pp. 44, 45*).—Fourteen varieties of tomatoes were grown under the supervision of the author to ascertain the variety best adapted to the climate, both for its yield and blight resistance. In consequence no spraying was done. Diseased plants began to appear early in June, and it seemed evident that there was considerable difference in the susceptibility to blight. The varieties Stone and Dwarf Aristocrat seemed to be most resistant, while Mayflower was very badly attacked. The previous recommendation that tomatoes be grown in the shade during the hot weather to check the attacks of blight was investigated by growing tomatoes alternating with rows of corn, but there was no appreciable difference between the number of blighted plants in the shade and open ground. As mechanical recommendations the author suggests the early removal of all diseased vines from the field, thorough ridding of plants of insect pests, and the maintenance of a thorough state of cultivation of the soil.

Dry rot, brown spot, or Baldwin spot of apples, W. T. MACOUN (*Canada Expt. Farms Rpts. 1899, pp. 96–99*).—A report on this disease was made in 1896 (E. S. R., 9, p. 850) in which it was described at considerable length. During subsequent years it has been under investigation, and in 1897 and 1898 19 varieties of apples at the Experimental Farm were affected, some crops having been so badly injured that the fruit was almost worthless. Although the trees had been thoroughly sprayed the fungicides appeared to have been without effect in reducing the disease.

From replies to circulars sent out by the author to the different fruit regions of Canada and the United States, it appears that at least 60 varieties are affected, the Baldwin seeming to be attacked the most. It is thought possibly this may be due to the fact that this apple is more extensively grown than any other variety in those regions where the spot is most prevalent. In range it extends from the Atlantic to the Pacific, being most prevalent in eastern Ontario, Quebec, British Columbia, and the eastern United States. Opinions of growers differ as to the cause, and the author quotes extensively from the Vermont Station Report for 1899 (E. S. R., 12, p. 258). As yet no remedy is known.

On the prevention of raspberry anthracnose by cultural methods, W. C. STURGIS (*Connecticut State Sta. Rpt. 1899, pt. 3, pp. 74–276*).—The raspberry anthracnose is briefly described and the investigations of Thaxter (E. S. R., 2, p. 482), and the experiments

conducted at the New York State Station (E. S. R., 9, p. 762), are reviewed. The latter seemed to indicate that for the prevention of this disease the use of fungicides was valuable, although the increased yield did not justify the expense.

An account is given of a badly infested plat of vines, in which severe pruning, followed by thorough cultivation and throwing the dirt over the diseased stems, resulted in an excellent growth of young shoots nearly free from the disease. As a possible explanation for this, it is stated that the diseased canes were largely removed by the pruning, and an unusually dry season prevented the development of the fungus.

White rot of the grape, L. RAVAZ (*Prog. Agr. et Vit. (Éd. L'Est), 21 (1900), No. 37, pp. 335–337, pl. 1*).—This disease is said to be due to the fungus *Coniothyrium diplodiella* or *Charrinnia diplodiella.* The fungus is considered as a semiparasite, being incapable of invading sound tissue, but whenever by accident the epidermis of the grapes is broken it readily attacks and destroys the fruit. This disease is said to be a quite common accompaniment of hailstorms, the hail injuring the grapes and permitting the entrance of the fungus. Experiments with fungicides for the prevention of the disease have shown that the spores of white rot will germinate in much stronger solutions of copper than those of the black rot, on which account any fungicide should be considerably stronger. As this fungus is dependent upon external agencies for its infection of the grape, preventive treatment can not be recommended as in the case of other diseases. It is stated that this fungus, unlike the Botrytis which causes the gray rot of grapes, does not produce any oxidizing diastase which is considered the cause of the condition of wine known as "casse."

Stem-rot disease of carnations, W. E. BRITTON (*Connecticut State Sta. Rpt. 1899, pt. 3, pp. 236–238*).—This disease was previously described by the author (E. S. R., 10, p. 262), the cause being determined to be a species of Fusarium. Other investigators have recorded similar diseases of cotton, tomatoes, muskmelons, and watermelons. In 1897 the author found snapdragon plants affected by a similar disease. In 1898 asters were similarly affected, so that it seems probable that carnation, snapdragon, and aster plants are attacked by the same or closely related organisms.

The methods by which the spores are wintered over and the infection of the plant are unknown. Attempts to inoculate healthy plants above ground have failed, while seemingly healthy plants one after another became diseased in a field as well as after being set in the forcing-house benches. On account of the extreme susceptibility of the variety, William Scott, this was discarded.

A series of culture experiments was conducted, in which the soil was removed from around plants to a depth of about 2 in. After the stems had become dry, they were coated with Bordeaux mixture, and the soil replaced. From time to time a number of plants were noticed

to be badly diseased or dead, and were removed. The experiment was conducted with soils consisting of coal ashes and peat and of compost. The average number of diseased plants was 4.3 and 3.4, respectively, for the 2 soils.

From the fact that healthy plants, one after another, became diseased in the benches, that coating them with fungicides did not prevent attacks, or removing diseased branches save any of the plants, the author is led to believe that the fungus gains access to the tissues of the host either through the rootlets or some portion of the root system considerably below the surface of the soil, and when the top begins to wilt, the plant is already in the last stages of the disease.

Some important fungi and fungicides, C. O. TOWNSEND (*Maryland Sta. Bul. 65, pp. 64–69, figs. 2*).—Popular descriptions are given of the causes of various plant diseases and directions given for the preparation and application of fungicides for their prevention.

Experiments on club root (finger and toe) (*Jour. Univ. Extension Col., Reading [England], Sup. 9, 1900, pp. 47–52; also Bd. Agr. [London] Rpt. Agr. Education and Research, 1899–1900, pp. 96–98*).—An account is given of soil treatment with lime, basic slag, caustic lime, chalk, and gas lime for the prevention of club root of cruciferous plants. All the lime preparations were found to give favorable results from their use.

The potato disease (*Gard. Chron., 3. ser., 28 (1900), No. 717, pp. 222, 223*).—The writer reports a very serious outbreak of potato rot in Ireland whereby the crop will be very materially lessened. Spraying was not practiced to any considerable degree.

Some tobacco diseases, J. F. GOUTIÈRE (*Jour. Agr. Prat., 1900, I, No. 16, pp. 569–571*).—Notes are given on the injury done by the orobanche (*Phelipea ramosa*) and descriptions of the mosaic disease of tobacco.

The smuts observed in Belgium during 1898, H. VANDERYST (*Rev. Gén. Agron. Louvain, 9 (1900), No. 7, pp. 297–302*).—A report is given of 48 species of smuts, representing 10 genera, that have been observed in different parts of Belgium. The distribution of these different smuts throughout the country is indicated.

Smut of sugar cane, C. A. BARBER (*Dept. Land Records and Agr., Madras, Vol. II, Bul. 39, pp. 155, 156, pl. 1*).—Notes are given on a serious outbreak of *Ustilago sacchari*. The smut is described and burning affected areas is recommended.

Concerning the proper use of artificial fertilizers for sugar beets and the relation with beet diseases, F. KUDELKA (*Bl. Zuckerrübenbau, 7 (1900), No. 8, pp. 113–121*).

Virescence and fasciation due to parasites, M. MOLLIARD (*Rev. Gén. Bot., 12 (1900), No. 140, pp. 323–327, figs. 3*).—A case of virescence in *Trifolium repens*, due to attacks of *Polythrincium trifolii*, and a fasciation of *Raphanus raphanistrum* are described and figured.

Investigations on Rhizoctonia violacea, M. GÜNTZ (*Fühling's Landw. Ztg., 48 (1899), No. 19, pp. 731, 732; abs. in Centbl. Bakt. u. Par., 2. Abt., 6 (1900), No. 15, pp. 506, 507*).—In an alfalfa field which had been devastated by this root parasite, potatoes, Jerusalem artichokes, and bush beans were planted with the result that some of each kind of plant were killed by the fungus.

The genetic relationship between Rœstelia koreænsis and Gymnosporangium japonicum, M. SHIRAI (*Ztschr. Pflanzenkrank., 10 (1900), No. 1, pp. 1–5, pls. 2*).—The relationship existing between these two fungi is shown by cultures upon Juniperus and pear leaves.

Note on Glœosporium cactorum, J. F. Clark (*Amer. Florist, 15 (1900), No. 611, pp. 841, 842, fig. 1*).—Notes the occurrence of this fungus on a number of species of cacti.

Fruit diseases and how to treat them, L. C. Corbett (*West Virginia Sta. Bul. 66, pp. 199–235, figs. 23*).—A number of the more common fruit diseases are popularly described and suggestions given for their prevention. A spray calendar is given for preventive treatment of the diseases of the apple, cherry, currant, grape, nursery stock, peach, apricot, nectarine, pear, plum, raspberry, blackberry, and strawberry. Formulas and directions for making insecticides and fungicides complete the bulletin.

The destruction of pear rust, C. Freiherr von Tubeuf (*Arb. K. Gesundheitsamte, Biol. Abt., Leaflet 3, Apr., 1900, pp. 4, figs. 5*).

American gooseberry mildew in Ireland, G. Massee (*Gard. Chron., 3. ser., 28 (1900), No. 713, p. 143, fig. 1*).—Notes the appearance of *Sphærotheca mors-uvæ* in Ireland and recommends spraying with a solution of potassium sulphid for preventing its attack.

Currant leaf spot, Weiss (*Prakt. Bl. Pflanzenschutz, 3 (1900), No. 1, pp. 1–3*).—Notes on *Glœosporium ribis* and means for its prevention.

Banana disease (*Trinidad Bot. Dept. Bul. Misc. Inform., 1900, No. 24, p. 254*).—Notes the destructive occurrence of *Marasmus semiustus* on banana plants. Experiments show that under good cultural conditions the fungus lives as a saprophyte, becoming destructive when the plants are weakened from any cause.

The diseases and enemies of coffee, G. Delacroix (*Les maladies et les ennemis des caféiers. Paris: Challamel, 1900, 2. ed. enl., pp. 216, figs. 50*).

The black rot in Jura during 1899, F. Jouvet (*Vigne Amer. et Viticult. Europe, 24 (1900), No. 5, pp. 146–149*).—Outbreaks of black rot were observed June 5 or 6, followed by second, third, and fourth appearances June 10 to 12, July 28 to 31, and August 5 to 7. Spraying experiments were conducted in which the best results were obtained from 5 applications of Bordeaux mixture. The addition of resin was without value, as shown by the results.

Notes on oidium in Burgundy, P. Pacottet (*Rev. Vit., 1900, No. 332, pp. 473–476*).

The prevention of Oidium tuckeri, J. Wortmann (*Mitt. Weinbau u. Kellerw., 1900, No. 1, pp. 1–6; abs. in Centbl. Bakt. u. Par., 2. Abt., 6 (1900), No. 9, pp. 301, 302*).—Notes the serious occurrence of this mildew in 1899. Investigations lead to the belief that it is wintered over in the bark of the vine. Sulphur is recommended as a preventive means.

Combating oidium on grapes, Kulisch (*Landw. Ztschr. Elsass-Lothringen, 1900, No. 17, pp. 238, 239*).

Diseases of plants, R. Hartig (*Lehrbuch der Pflanzenkrankheiten. Berlin: J. Springer, 1900, pp. IX+290; noted in Allg. Forst u. Jagd Ztg., 76 (1900), June, pp. 205, 206*).—A third and revised edition of "The diseases of trees."

Fungus diseases of shade trees, W. Lockhead and M. W. Doherty (*Canad. Hort., 23 (1900), No. 4, pp. 133–141, figs. 12*).—Notes are given on tree-root rot (*Agaricus melleus*), root rot of conifers (*Trametes radiciperda*), heartwood rots (*Polyporus sulphureus, P. betulinus*, etc.), apple-tree canker (*Nectria ditissima*), spruce canker (*N. cucurbitula*), coral spot canker (*N. cinnabarina*), larch canker (*Peziza willkomii*), pine tree fungus (*Trametes pini*), pine cone fungus (*Peridermium pini*), cedar apples (*Gymnosporangium* sp. and *Rœstelia* sp.), lichens, maple-leaf blotch (*Rhytisma acerinum*), and pine-leaf cast (*Lophodermium pinastri*), together with suggestions for preventing injurious attacks upon their hosts.

Notes on the Peridermium of Pinus strobus (*Bul. Soc. Cent. Forst. Belg., 7 (1900), No. 8, pp. 577–579*).—This fungus is said to have spread rapidly through the forests of Belgium during the past 2 or 3 years and is becoming a serious enemy to the plantations of white pine. The different forms of the fungus, one of which grows on pines and the other upon species of Ribes, are described. It is said that the Peri-

dermium developed in July and August on the bark of *Pinus sylvestris* is not to be confounded with that occurring on *P. strobus.*

Some causes of pine-leaf cast, FROMBLING (*Ztschr. Forst. u. Jagdw., 32 (1900), No. 8, pp. 462-467*).—Unfavorable atmospheric conditions are said to cause pine-leaf cast.

Combating pine-leaf cast, KIENITZ (*Ztschr. Forst. u. Jagdw., 32 (1900), No. 6, pp. 364-373*).—Spraying young pine trees with Bordeaux mixture between the first and fifteenth of August is recommended for the prevention of leaf cast.

A fungus disease of cottonwood, S. A. BEDFORD (*Canada Expt. Farms Rpts. 1899, p. 322*).—It is reported that for the past 2 or 3 seasons the cottonwood (*Populus deltoidea*) has been seriously affected by a fungus disease which destroys the leaves. During the summer a growth, resembling rust, makes its appearance on the leaves, especially on the young succulent ones, which in a short time are discolored and fall from the tree. In the following spring a large portion of the wood is found to be in a dying condition. The value of fungicides for controlling this disease will be a subject of investigation during the coming season.

The influence of copper fungicides on the quality of wine, E. CHUARD (*Chron. Agr. Canton Vaud, 13 (1900), No. 18, pp. 451-457*).—The claim is made that in years when atmospheric conditions are favorable for ripening the grapes the application of copper solutions has no effect upon the quality of wines, but in cold seasons unfavorable for ripening the fruit that process is further retarded by the action of the fungicide on the plant whereby its functions of growth are prolonged and the maturation delayed.

Formalin as a fungicide for bean anthracnose, S. A. BEDFORD (*Canada Expt. Farms Rpts. 1899, p. 323*).—A series of experiments were conducted in which beans were soaked for 2 hours in a solution of 1 oz. of formalin to 1 gal. of water. The germination of the beans was not appreciably affected by either this or stronger solutions, and the test seems to indicate that formalin is a useful deterrent to the bean anthracnose.

Potassium permanganate as a fungicide, M. TRUCHOT (*Vigne Amer. et Viticult. Europe, 24 (1900), No. 6, pp. 187-190*).—The addition of 125 gm. of potassium permanganate to 100 liters of copper fungicide or a simple solution of 125 gm. of potassium permanganate, 3 kg. lime, and 100 liters of water are recommended as fungicides for spraying grapes.

Acetate of copper as a fungicide, J. DURAND (*Vigne Amer. et Viticult. Europe, 24 (1900), No. 4, pp. 118-120*).—In efficiency and ease of application this compound is thought to equal Bordeaux mixture.

Preparation of Bordeaux mixture, G. BATTANCHON (*Vigne Amer. et Viticult. Europe, 24 (1900), No. 7, pp. 198, 199*).—Directions are given for the proper preparation of a neutral Bordeaux mixture. The method described is essentially that given in Farmers' Bulletin 38 of this Department (E. S. R., 8, p. 240).

ENTOMOLOGY.

Report of the entomologist, J. FLETCHER (*Canada Expt. Farms Rpts. 1899, pp. 159-184, figs. 15*).—Brief popular notes are given on a large number of injurious insects. The Hessian fly is reported as having been unusually destructive during the past year. From an examination of specimens collected in various parts of Manitoba, it is believed that there is only one brood of the Hessian fly in that region. The remedies recommended against this insect are late sowing of wheat, burning of rubbish, and burning or plowing under the stubble. *Polyg-*

notus hiemalis and *Merisus destructor* are reported as parasites of the Hessian fly. The destructive pea aphis caused serious losses to sweet peas and field peas at Ottawa and other points. Experiments were conducted in spraying plants with the tobacco and soap mixture composed of 10 lbs. of tobacco leaves and 2 lbs. of whale-oil soap to the barrel of water. Most of the plant lice were destroyed. Brief notes are given on *Crioceris asparagi* and *C. 12-punctata*. As remedies against these insects the author recommends dusting plants in summer with lime, spraying with arsenites, beating the plants, and the use of trap plants.

The black violet aphis was very destructive to violets under glass at Toronto. Fumigation with tobacco is not to be recommended, since violets are usually injured by this substance. The use of hydrocyanic-acid gas for greenhouse fumigation is preferred. Descriptive biological and economic notes are also given on *Bryobia pratensis*, *Phlyctænia ferrugalis*, and *Lyda multisignata*.

The report on the apiary at the Central Experimental Farm is made by J. Fixter. Eighteen colonies of bees were removed from winter quarters on April 1, and 6 were placed in the house apiary, 6 in the sheltered apiary, and 6 in the exposed apiary. It was noted that while the weather was cool with cold winds, bees which were sheltered were flying, while those which were exposed did not leave the hive. Brief practical suggestions are given on the management of bees in summer.

Some insects of the year 1899, R. H. Petit (*Michigan Sta. Bul. 180, pp. 117–141, figs. 15*).—The red spider is reported as injurious to plum, apple, peach, chestnut, and honey-locust trees. The greatest amount of damage was done to apple, plum, and peach trees. The red spider was observed usually on the underside of the leaves, but on both sides of chestnut leaves. Various distortions were produced in the leaves by the attack of these mites.

The European fruit scale (*Aspidiotus ostreæformis*) is reported as injurious to soft maple, currant, mountain ash, and apple trees. The natural enemies of this insect observed in Michigan are *Smilia misella* and *Chilocorus bivulnerus*. A detailed description is given of this species of scale louse.

Economic and biological notes are presented on the following species: *Tischeria malifoliella*, *Loxostege sticticalis*, *Systena tæniata blanda*, *Disonycha triangularis*, *Epicauta cinerea*, *Diabrotica vittata*, *Typophorus canellus*, *Euphoria inda*, and *Selandria rubi*.

Brief suggestions are given regarding formulas and the use of the more common insecticides.

A recent observation on Filaria nocturna in Culex, G. C. Low (*British Med. Jour., 1900, No. 2059, pp. 1456, 1457, pl. 1*). The author studied the life history of this Filaria in *Culex ciliaris*. In

order to study the anatomy of the mosquito with reference to the possible migration of the worms, sections of infected mosquitoes were made after embedding in celloidin. It was found that the young filariæ, after reaching their highest stage of development, did not remain passive in the thoracic muscles but left that tissue and, traveling forward in the direction of the head, passed into the loose cellular tissue which abounds in the prothorax in the neighborhood of the salivary glands. After a short stay in the thorax the worms passed forward into the head and coiled up in the connective tissue below the cephalic ganglion and the salivary duct. From these positions the filariæ make their way into the proboscis through an independent opening in the labium. From this position it is easy to understand how they may infect man.

The clover-root borer (Hylastes obscurus), F. M. WEBSTER (*Ohio Sta. Bul. 112, pp. 143-149, pl. 1*).—This insect passes the winter in Ohio in all stages, but chiefly in the adult condition. The author gives brief descriptions of the insect in its different stages. A table is presented showing the condition in which the insect is found during the different months of the year. At the beginning of the year adults and larvæ are present, but pupæ are seldom seen. The first eggs were found on May 17, and pupæ which were found on March 2 and May 31 came from hibernating larvæ. The new brood of larvæ begin work during the first week of June. The insect does not attack young clover during the first year, but seems to prefer clover during the second year from the seed. The injury is done largely before the first of August.

An experiment was tried at the station in devising a method for combating this insect. In June, 1897, a plat of ground 16 by 20 ft. was seeded to red clover. On July 7, 1899, an examination of the clover plants disclosed the presence of larvæ of this insect. On the following day the plat was plowed to a depth of from 4 to 5 in. An examination of this plat on August 10 resulted in finding only a single pupa and 3 nearly full-grown larvæ 2 or 3 in. below the surface, while other larvæ and pupæ were found deeper in the soil. On August 11 an insect cage was placed over a part of this plat to prevent the escape of adult insects. The plat was examined on October 19 with the result that only 4 live beetles were found. The beetles were abundant at the same time in outside fields.

The author believes that deep and thorough plowing immediately after harvesting the first crop of clover will result in the destruction of the majority of these insects.

Combating the gypsy moth (Porthetria dispar), Y. SJÖSTEDT (*Meddel. K. Landtbr. Styr., 1900, No. 1, pp. 29, pls. 2, figs. 2*).—The author reports an unusually serious outbreak of the gypsy moth during the past 2 years in the southeastern part of Sweden, in Blekinge and Kal-

mar counties. The gypsy moth was reported from Karlskrone in 1840 and even as late as 1891 was considered a rare insect in that region. The area which was infested during the outbreak under discussion amounted to about 100 sq. kilometers. The food plants which the insect seemed to prefer were oak, poplar, willow, birch, apple, peach, beam tree, spruce, blueberry, clover, and grasses. The infested country was of a rough nature and contained many large stone piles and stone walls, in which the eggs were laid.

A government appropriation was secured and work was begun in the spring in the destruction of the eggs. The egg masses were treated for this purpose with black varnish, $\frac{1}{3}$ kg. of this substance being sufficient to treat 200 egg masses. In all, 2,025 kg. of black varnish and 660 kg. of Raupenleim were employed in the spring work. The total number of eggs destroyed by these methods was estimated at 377,500,000. The spring work extended from April 11 to May 13, and during this time 7,941 stone piles and 36,048 meters of stone wall were examined. The number of men employed varied from 88 to 115, and the total number of days' work in the spring operations was 1,839. The first gypsy moth larvæ hatched out during the last days of April while the temperature varied from zero to 18° C. In general, the larvæ were found to hatch during the time between the first appearance of green and the development of the leaves. During the summer the infested area was carefully examined, the work extending from July 10 to July 21. Stone walls which were badly infested with eggs were surrounded with a line of narrow boards which had been smeared with Raupenleim in order to prevent the escape of the larvæ. The total number of days' work in the spring and summer operations was 2,290 and the total expense was about $925.

Among the natural enemies of this insect, the author mentions starlings, cuckoos, crows, magpies, and a number of parasitic Hymenoptera and Diptera. The author's observations upon the life history of the gypsy moth may be summarized as follows: The eggs which have survived the winter hatch at about the time of the first vegetative development. The number of eggs in 20 egg masses which were carefully counted varied from 172 to 682, with an average of 339. The larvæ undergo 4 distinct developmental stages. The larval period varies from 9 to 10 weeks and the pupal stage from 12 to 14 days. The males appear during the last week in July and the females during the first week in August. The deposition of the eggs begins in from 2 to 6 hours after fertilization and occupies from 7 to 12 days.

A new method of combating the gypsy moth, Röric (*Arb. K. Gesundheitsamte, Biol. Abt., 1 (1900), No. 2, pp. 255–260, figs. 2*).—The author, after inspection of the work of the gypsy moth commission in Massachusetts in fighting this insect, came to the conclusion that the methods adopted there did not give hope of ultimate success.

In Germany the gypsy moth has never become so injurious as in the United States, but the author suggests that it may become so at any time.

The methods for destroying the eggs of the gypsy moth which have thus far been practiced are collecting and burning, painting with Raupenleim, and treatment with a mixture of tar and kerosene. The author's chief objection to these methods is that some of the eggs in each cluster may be brushed from the tree and escape destruction. He has devised a cheap and convenient apparatus which is claimed to be well adapted for the destruction of the eggs. This consists of a tank which holds about 200 cc. of kerosene. The escape pipe is in the form of a small tube, and the whole apparatus may be carried in the hand or at the end of a pole of any required length according to the height of the egg clusters. A string attached to a valve and extending down the pole allows the operator to regulate the amount of kerosene discharged upon each egg cluster.

Washes and sprays for combating plant lice, woolly aphis, and similar pests, E. FLEISCHER (*Ztschr. Pflanzenkrank., 10 (1900), No. 2, pp. 65–70*).—The author conducted experiments with Halali, kerosene emulsion, Verminol, insect soaps, and Sapokarbol. A 2 per cent solution of Halali was ineffective and the author found that in order to destroy all insects a 16 per cent solution must be employed. The substance was found to be somewhat injurious to the plant tissues. The kerosene emulsion employed contained extracts of tobacco or quassia. A 5 per cent solution was found to be very effective and did not cause injury to the plants. The author believes that Halali is a very good remedy for plant lice, but that the practical objection to it is the high price. The kerosene emulsion, Verminol, and insect soap are not believed to possess advantages which outweigh their costliness. The author especially recommended Sapokarbol as a remedy for the destruction of woolly aphis.

A test of spray nozzles, N. O. BOOTH (*Missouri Sta. Bul. 50, pp. 85–115, figs. 10*).—A comparative study was made of 30 kinds of nozzles from different manufacturers, with reference to the following points: Height of spray or distance which the spray could be thrown perpendicularly with various pressures; width, shape, and distribution of the spray at the point where it was considered most efficient; size of the drops; amount of liquid discharged by each nozzle in a given time; liability of the nozzle to clog; liability to dribble; durability, and method of attachment.

The author classifies the different nozzles in the following manner: Class I. Nozzles which throw a solid more or less round stream. Class II. Nozzles in which the spray is somewhat broken directly by the action of the margin of the outlet. Class III. Nozzles in which the stream, after having passed the outlet proper, is broken into a

spray by striking against the projecting parts of the nozzle. Class IV. Nozzles in which a rotary motion is given to the liquid in a chamber near the outlet. Class V. Nozzles in which the liquid escapes in 2 converging streams which, acting upon each other, break the liquid into a spray.

In determining the height of spray, no account was taken of the highest point to which isolated drops were thrown, but an attempt was made to establish what is called the spraying distance, or the distance from the mouth of the nozzle to the point where the bulk of the spray is best broken up. It was found practically impossible to determine in what shape the spray is most desirable. The most essential points seemed to be the securing of a spray which, when passed at a uniform rate over any surface, will cover every part touched with a film of liquid of equal thickness. In order to compare the different nozzles with reference to this matter, they were made to throw a spray at the spraying distance of each one down into galvanized-iron boxes 6 in. square, which were placed closely side by side. In each case the fluid was allowed to run until those cans which received most were nearly full.

For determining the size of the drops thrown by different nozzles, a barrel and a half of brownish-black ink was made with logwood and the spray was directed against blank sheets of paper placed at the best distance for each nozzle. The papers were then photographed.

The quantity of water discharged by the different nozzles was determined in quarts per minute at a pressure of 30 lbs.

In testing the matter of clogging a 6-lb. Bordeaux mixture was used, and it was found that when this mixture was carefully and cleanly prepared none of the nozzles clogged during the 5 minutes which were allowed for the test.

Tests showed that many otherwise excellent nozzles had the disadvantage of dribbling to a considerable extent.

The question of durability is one not easy to determine, since in most cases it will be considered better to buy a new nozzle than to continue the use of one which has become defective through wear.

The author states that no general-purpose nozzle has been perfected. The choice of a nozzle must necessarily depend largely upon the kind of work for which it is to be used. One of the most important points in determining the choice of a nozzel is the distance to which the spray must be thrown.

Bees and bee culture, A. Kunakhovich (*Selsk. Khoz. i Lyesov., 195 (1899), Oct., pp. 145–210; Nov., pp. 327–406, figs. 50*).—An elaborate discussion of the problems connected with apiculture, including the anatomy of the bee, varieties of bees, bee food, bee products, breeding of bees, natural swarming, artificial swarming, removal of queens, a system of apiculture with 2 queens in each hive, an economical study of apiculture, honey plants, etc.

An unusual application of propolis by bees in the wild state, X. Tapie (*Rev. Internat. Apicult., 22 (1900), No. 9, pp. 165–167*).—The author made observations on a swarm of bees which was living in a cavity under a large rock. The bees had constructed a wall of propolis for protective purposes.

Report of the entomologist, A. D. Hopkins (*West Virginia Sta. Rpt. 1899, pp. 25–36*).—The chief work of the entomological department of the station for the year was upon forest insects and life zones. The author gives a detailed statement of various trips made in the State for the purpose of studying these matters. Progress is reported in the study of timothy varieties. Recent reports from correspondents concerning the San Jose scale indicate that this insect has not become a serious pest in any counties of the State west of the mountains.

Insect notes, W. E. Britton (*Connecticut State Sta. Rpt. 1899, pt. 3, pp. 240–244*).—Notes are given on the appearance of the pea-plant louse (*Nectarophora destructor*) in the State. It is reported that *Schizoneura rileyi* was injurious to the branches of elm trees during the season. Irregular, warty growths are produced on the branches or trunks of the trees by this insect. The spruce-bud louse (*Adelges abieticolens*) was found infesting the twigs of spruces. Notes are given on a number of scale insects, including *Lecanium armeniacum*, which was found upon grapes and other fruit trees. A beetle which infested wheat middlings and did considerable damage in such situations proved to be *Læmophlæus pusillus*. Garden primroses and also the native evening primrose were badly injured by the attacks of *Haltica marevagans*. It is stated that fall cankerworms are much less numerous than during previous years.

How insects are studied at the Ohio Agricultural Experiment Station, F. M. Webster (*Ohio Sta. Bul. 114, pp. 165–173, pls. 2*).—The author presents a popular account of the insectary and breeding cages at the experiment station, and of the methods of collecting, rearing, preserving, and labeling insects.

Note on Collops bipunctatus, T. D. A. Cockerell (*New Mexico Sta. Bul. 33, pp. 50, 51*).—A brief account of the known distribution of this insect.

The female of Eciton sumichrasti, with some notes on the habits of Texan ecitons, W. M. Wheeler (*Amer. Nat., 34 (1900), No. 403, pp. 563–574, figs. 4*).—Notes on the appearance and biology of species of the foraging ants.

Synopsis of food habits of the larvæ of the Sesiidæ, W. Beutenmüller (*Canad. Ent., 32 (1900), No. 10, pp. 301–303*).—The author gives brief notes for the purpose of indicating the host plants of these insects and the parts of the host plants which are attacked.

The Coccidæ of Brazil, A. Hempel (*Rev. Museū Paulista, 4 (1900), pp. 365–537, pls. 8*).—Descriptive, biological, and economic notes on a large number of species of Coccidæ, some of which are described as new.

Effect of lime on the oyster-shell bark louse, W. T. Macoun (*Canada Expt. Farms Rpts. 1899, pp. 94–96*).—During the previous year in experiments conducted for another purpose it was noted that whitewash was a very effective remedy for the oyster-shell bark louse. Further experiments are now in progress, from which no definite conclusions can be drawn as yet. The insecticide as used in this experiment is composed of 6 gal. skim milk, 30 gal. of water, 60 lbs. of lime, and 10 lbs. of salt. Certain trees which were not treated with whitewash received a spray of tobacco water and whale-oil soap made by using 10 lbs. of tobacco, 2 lbs. of soap, and 40 gal. of water. The trees were sprayed June 1 and again June 6, with the result that nearly all the insects were destroyed.

An enemy of the Colorado potato beetle, C. E. Mead (*New Mexico Sta. Bul. 33, pp. 47–49*).—This article has been previously noted (E. S. R., 11, p. 767).

Preliminary notes on the rate of growth and on the development of instincts of spiders, Annie B. Sargent (*Proc. Acad. Nat. Sci. Philadelphia, 1900, No 2, pp. 395–411, pls. 2*).—This paper contains a record of observations on *Argiope cophinaria* and *Agalena nævia*. It was observed that increase in size takes place between the

molts and is dependent on the food. Molting did not occur at regular intervals, but according to the amount of food. Cannibalism was not noted while the young were in the cocoon. Experiments indicated that young spiders could withstand a very cold, moist atmosphere but not a warm, dry one.

Inspection and care of nursery stock, W. E. Britton (*Connecticut State Sta. Rpt. 1899, pt. 3, pp. 245–251*).—A revised form of Bulletin 129 of the station (E. S. R., 11, pp. 270, 271).

Bisulphid of carbon for the destruction of insects in stored seeds (*Amer. Gard., 21 (1900), No. 303, p. 679*).—Brief notes on the method to be adopted in using this insecticide.

The chemistry of insecticides, F. T. Shutt (*Canada Expt. Farms Repts. 1899, pp. 148, 149*).—An analysis of Paris green indicated the presence of 44.2 per cent arsenious acid, 4.56 per cent of which was soluble in water. A kerosene-carbolic emulsion containing 2 gal. kerosene, 1 gal. of water, $1\frac{1}{2}$ lbs. of soap, and 2 pt. of crude carbolic acid is reported as effective in the destruction of the oyster-shell bark louse and tree borers. The emulsion as just given should be diluted in 8 parts of water. A correspondent suggested the addition of blue vitriol to the kerosene emulsion for use on dormant trees. Experiments indicated that the blue vitriol caused the immediate separation of the constituents of the emulsion, and therefore this combination can not be recommended. A Bordeaux mixture, 4:4:40, was mixed with a strong decoction of tobacco in equal proportions. A slight separation took place after long standing, but it is believed that if this mixture be sprayed in a fresh condition the tobacco would have no injurious effect upon the Bordeaux mixture.

Some important insecticides, fungicides, and apparatus for their application, W. G. Johnson, C. O. Townsend, and H. P. Gould (*Maryland Sta. Bul. 65, pp. 55–63*).—A popular account of the insecticides most commonly applied in the destruction of biting and sucking insects, with brief notes on the time of application of these insecticides and formulæ for their preparation.

Some important spraying apparatus and other accessories, H. P. Gould (*Maryland Sta. Bul. 65, pp. 70–89, figs. 16*).—This article contains a popular discussion of bucket pumps, knapsack pumps, barrel pumps, kerosene pumps, horizontal pumps, nozzles, suggestions for the use of spraying apparatus, and a spray calendar.

FOODS—ANIMAL PRODUCTION.

Preliminary report upon the composition and properties of the fat in "firm" and "soft" pork, F. T. Shutt (*Canada Expt. Farms Rpts. 1899, pp. 151–155, pl. 1*).—In view of the importance of firm pork for the bacon industry, analyses were made of the ham and shoulder in what was regarded as firm pork of excellent quality and in soft pork of very inferior quality. The results follow:

Composition of fatty tissue in firm and soft pork.

	Water.	Salt.	Nitrogen.	Nitrogenous tissue.	Fat by difference.	Olein in bacon.	Palmitin and stearin in bacon.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Firm pork:							
Ham	15.56	2.73	0.504	3.15	78.56	50.05	28.[illegible]1
Shoulder	6.53	1.12	.285	1.78	90.57	58.33	52.24
Soft pork:							
Ham	12.50	1.84	.243	1.52	84.27	66.37	17.90
Shoulder	2.67	.48	.142	.89	95.96	76.94	19.02

"It is to be observed that the percentage of water in the fatty tissue of the 'firm' is greater than in the fatty tissue of the corresponding part of the 'soft' bacon. Also, that the percentage of tissue other than fat, that is, of a nitrogenous nature, was also greater in the 'firm' than in the 'soft.' This falls into line with the results [previously] stated, . . . since the water for the most part is contained in or held by the nitrogenous tissue. This would indicate that the walls of the cells containing fat proper are thicker in the 'firm' than in the 'soft' or 'tender' bacon. Further, it is to be noticed that the amounts of salt present are also larger in the 'firm' than in the 'soft' bacon. This is accounted for by the assumption that the salt, like the water, is held by the nitrogenous tissue to a greater extent than in the fat.

"The percentages of fat are, from a consideration of the foregoing statements, necessarily greater in the 'soft' than in the 'firm' bacon. The fat proper consists of olein, fluid at ordinary temperatures, and palmitin and stearin, solid at ordinary temperatures. The data show that the percentage of olein is much greater in the 'soft' than in the 'firm' bacon, while as a natural consequence the percentages of palmitin and stearin are greater in the 'firm' than in the 'soft' bacon. These facts furnish the cause of the greater softness in the 'soft' or 'tender' bacon."

The composition of the rendered fat of firm and soft pork was also determined, as well as the usual constants.

"[In the author's opinion] the melting point of the fat from the 'soft' bacon is practically 10° C. lower than that of the 'firm' bacon. The specific gravities in both series are so close that it is not possible to use this constant as a means of differentiation or for deducing therefrom any information respecting the relative composition of the fats. The saponification equivalent likewise appears to be of little value in the diagnosis. The Reichert number shows the practical absence of volatile fatty acids in both series, though there is an indication of larger traces of the presence of such in the shoulder fat than in that of the ham. The 'iodin absorbed' is of great value in this investigation. From it may be calculated the percentage of olein or liquid fat present in a fat. The data here presented clearly demonstrate the larger amount of olein in the 'soft' fat, a fact that gives the explanation for the greater softness or tenderness of the 'soft' bacon."

These investigations are being continued, and in order to determine the effect of food on the composition of the pork, the olein, palmitin, and stearin, and the ratio of the two latter to the former was determined in the bacon of several young pigs ranging from 23 to 42 lbs. in weight.

Feeding experiments with steers to test the value of cocoa shells, F. ALBERT (*Landw. Jahrb., 28 (1899), No. 5–6, pp. 972–975*).—A test was made at the Lauchstädt Experiment Station to investigate the feeding value of cocoa shells, a by-product from chocolate manufacture. Two lots of steers were used. Both lots were fed diffusion residue, alfalfa hay, straw, molasses bran, cotton-seed meal, and wheat bran. In addition, lot 1 was given cocoa shells, 0.5 kg. per 1,000 kg. live weight being fed at the beginning of the test, and the amount gradually increased to 10 kg.

During the test lot 1 made an average gain of 1.8 kg. per head and lot 2, 1.7 kg. The author concludes that cocoa shells are a satisfactory and healthful feeding stuff and that steers readily learn to eat them. Cocoa shells are regarded as intermediate in feeding value between meadow hay and wheat bran.

The value of maize-germ-molasses feed for fattening lambs, F. ALBERT (*Landw. Jahrb., 28 (1899), No. 5-6, pp. 987-994*).—At the Lauchstädt Experiment Station the value of a feeding stuff made of maize germ and molasses was tested. Two lots of 17 and 20 lambs each were used. The test proper began July 28, 1897, and closed October 15. Feeding a constant basal ration of 70 kg. of beet chips, 15 kg. of pea straw, 3 kg. of ground peas per 1,000 kg. live weight, a mixture of 7.5 kg. of the molasses feed, 1.128 kg. of wheat bran, and 4.276 kg. of rape-seed cake per 1,000 kg. live weight, was compared with one of 1 kg. of wheat bran, 4.325 kg. of rape-seed cake, and 6.283 kg. of corn meal. About the middle of the test the amount of molasses feed was increased to 10 kg.

The average daily gain of the lambs on the molasses feed was 0.154 kg. when 7.5 kg. was fed, and 0.127 kg. when 10 kg. was fed. Lambs fed the corn-meal ration gained on an average 0.108 kg. per head daily.

The principal conclusions were that maize-germ-molasses feed is very satisfactory for lambs, and gives better results than corn meal. As shown by slaughter tests, it produced better flesh than the similar ration without molasses.

Experiments with lambs to study the effect of different concentrated feeding stuffs on the character of the tallow, F. ALBERT (*Landw. Jahrb., 28 (1899), No. 5-6, pp. 975-987*).—The effect of different feeding stuffs on the tallow was tested with 4 lots of crossbred English lambs at the Lauchstädt Experiment Station. After a preliminary period of about 2 months, the feeding test proper began February 25 and closed June 14. The lambs were shorn about a month before the beginning of the test. All the lots were fed a basal ration of ensiled beet pulp, meadow hay, and straw. In addition, lot 1 was fed maize and sunflower-seed cake; lot 2, ground peas and wheat bran; lot 3, peanut cake and barley bran; and lot 4, wheat bran and rape-seed cake. The character of the fat of these different feeding stuffs was investigated. A number of lambs sickened or died during the test, and at the close lot 1 contained 7 lambs, lot 2 4, and lots 3 and 4 8 each. The average daily gain ranged from 0.148 to 0.203 kg. per lamb. The lambs were slaughtered and the tallow and other fat examined. The principal conclusions were that the fat consumed in the concentrated feeding stuffs may exercise a marked influence upon the character of the tallow. Especially good results, both as regards the improvement of the flesh and tallow, were obtained with sunflower-seed cake. Good results also attended the feeding of rape-seed cake and bran. Peas and peanut cake gave less satisfactory results.

Feeding experiments with pigs on the value of sugar and influence of increased protein consumption, F. ALBERT (*Landw. Jahrb., 28 (1899), No. 5-6, pp. 943-962*).—A test was made at the Lauchstädt Experiment Station with 6 lots of 2 pigs each to determine the feeding

value of sugar and to learn the amount of protein and non-nitrogenous material best suited for fattening pigs. Lots 1 and 6 were fed a normal ration consisting, per 1,000 kg. live weight, of 80 kg. of cooked potatoes, 80 kg. of skim milk, 10 kg. of barley, furnishing 5 kg. of protein and 28 kg. of non-nitrogenous nutrients. The nutritive ratio was 1:5.7. Lots 2 and 5 were fed a ration rich in protein, receiving per 1,000 kg. live weight, 80 kg. of cooked potatoes, 40 kg. of skim milk, 5 kg. of meat meal, and 12.5 kg. of ground barley. This ration had a nutritive ratio of 1:4.92, and furnished 7.5 kg. of protein and 28 kg. of nitrogen-free nutrients. Lots 3 and 4 were fed a ration deficient in protein consisting, per 1,000 kg. live weight, of 80 kg. of cooked potatoes, 20 kg. of ground barley, and 10 kg. of sugar, furnishing 2.5 kg. of protein and 40 kg. of nitrogen-free material. This ration had a nutritive ratio of 1:15.

This ration was fed from February 27, 1898, to April 27, this being regarded as a preliminary period. From April 27 until the close of the test proper, June 15, the amount of potatoes fed the different lots was reduced to 60 kg. The amount of the other feeding stuffs was also changed somewhat, but the proportion of protein to nitrogen-free material was about the same.

At the beginning of the preliminary period the pigs weighed about 50 kg. each. During the test the pigs of lot 1 and 6 gained 0.718 kg. per head per day; those in lots 2 and 5, 0.661 kg.; and those in lots 3 and 4, 0.929 kg. The pigs receiving the large amount of protein had not gained as much as was expected; therefore, the test was continued 77 days with lots 2 and 5, the ration being increased by the addition of 12 kg. of sugar per 1,000 kg. of live weight. One pig was dropped out on account of illness. The average daily gain of the others was 0.525 kg. All the lots were slaughtered and the flesh judged by an expert, The ratio of dressed weight to live weight was practically the same, ranging in the different lots from 76.1 to 76.6 per cent. In the author's opinion the differences between the individual members of the lots were more marked than between the different lots. The belly fat and the lard of the different lots were examined.

The principal conclusions follow: A ration containing 5 kg. of digestible protein and 28 kg. of digestible nitrogen-free material per 1,000 kg. live weight suffice for producing a gain of 0.5 kg. per head per day. Increasing the digestible protein did not have a beneficial effect. Meat meal is a suitable nitrogenous feeding stuff when only gains in weight are considered. Sugar, when fed in a ration furnishing 5 kg. of digestible protein and 40 kg. of digestible nitrogen-free nutrients per 1,000 kg. live weight, gave very satisfactory results. Better results may be expected if a ration containing sugar and having a wide nutritive ratio supplements for a few weeks a period with a normal ration. Definite results regarding the effect of the different rations on the composition of flesh and fat were not drawn.

Report of the poultry manager, A. G. GILBERT (*Canada Expt. Farms Rpts. 1899, pp. 205–223, pl. 1*).—The work of the poultry department during the year is briefly reported. Generally speaking, pullets laid more eggs than year-old hens or those 3 or 4 years old. The eggs of older hens were larger and if sold by weight would be more valuable. The weight of a dozen eggs ranged from 1 lb. and 11 oz. in the case of the Barred Plymouth Rock, White Brahma, Black Minorca and Andalusian hens, to 1 lb. and 4 oz. in the case of Brown Leghorn pullets. Brief statements are made on the poultry hatched, the rations fed to old hens and pullets. In a test comparing whole ground grains with poultry having limited runs the following results were obtained: Five Barred Plymouth Rock cockerels fed whole grain gained in 14 weeks 18 lbs. 12¾ oz.; 5 White Plymouth Rock cockerels fed ground grain gained in the same time 20 lbs., 3¼ oz.; and 5 Silver Laced Wyandottes fed a mixture of whole and ground grains gained 15 lbs., 14¼ oz. In every case the chickens were fed per head daily 12 oz. of grain (wheat, barley and corn, 2:1:1). Crossbred cockerels, when confined in small coops and fed an ordinary ration, gained in 4 weeks from 12¾ oz. to 1 lb. 5 oz. The 3 best birds at the end of 5 months weighed on an average of 5 lbs. 1 oz. each.

Brief statements are made concerning the breeding pens, the feeding of chickens and pullets, and other points usually touched upon in these reports.

Feeding chickens for growth, G. M. GOWELL (*Maine Sta. Bul. 64, pp. 89–96*).—A number of tests with chickens are reported. In the first, the effect of small coops v. houses with small yards, on rapidity of growth, was studied. Forty Barred Plymouth Rocks, White Wyandottes, and light Brahmas (Eaton strain), were confined in small coops such as are used by English and French chicken and poultry fatteners, 4 chickens being placed in each coop. All were fed porridge made of skim milk and mixed meal containing corn meal, wheat middlings, ground oats and animal meal, 10:8:5:4. Twenty chickens of the same breeds were confined in houses with small yards and fed the same ration. All the chickens were 130 days old at the beginning of the trial, which covered 35 days. The average gain of the chickens confined in coops was 2.23 lbs., and of those in houses with yards 2.47 lbs., the amount of dry meal required per pound of gain being 5.94 and 6.52 lbs., respectively. The author calculates that the value of the chickens was increased $19.39 by fattening. "In these tests greater total and individual gains and cheaper flesh production were secured from birds with partial liberty than from those in close confinement. The labor was less in caring for the yarded birds. The cooped birds were very quiet and did not appear to suffer from confinement."

To determine the effects of age on gains in weight, 45 Plymouth Rock chickens, 177 days old at the beginning of the trial, were fed under the same conditions as above, 20 chickens being confined in coops

and the remainder in houses with small yards. In 21 days the average gain of the chickens confined in coops was 0.87 lb., 8.2 lbs. of grain being required per pound of gain. The average gain per chicken of the lot fed in houses with yards was 0.92 lb., the grain required per pound of gain being 7.36 lbs. The profits are estimated at 8.25 cts. per chicken. In the author's opinion these tests show that it is more profitable to fatten young chickens, for although the difference in age of the lots in the 2 trials reported was not great, much more satisfactory results were obtained with the younger birds.

The effect of green food was tested with 24 Plymouth Rock chickens 140 days old at the beginning of the trial. They were confined in lots of 4 in small coops and fed for 4 weeks on a ration of mixed meal and skim milk as described above. Two of the lots received no green food; the others were fed once a day all the finely chopped green rape they would eat during the last 2 weeks of the trial. When no green food was supplied, the gains ranged from 3.7 to 4.3 lbs. per coop; when rape was fed, from 3.5 to 4.4 lbs.

Breeding for egg production, G. M. GOWELL (*Maine Sta. Bul. 64, pp. 97–102*).—A record is given of the eggs laid by the hens employed in experiments on the possibility of securing breeds which shall excel in egg production. Of the 236 hens employed, 39 laid 160 or more eggs and 35 laid less than 100 eggs in a year. Great variations were observed in the laying capacity of the hens and in the regularity of laying, although all the hens were given the same food and care, and the chickens in each breed tested were selected for their uniformity. It was noticed that the eggs from hens that laid the greatest number were on an average smaller in size than those from hens producing fewer eggs, and the percentage of infertility was also greater in the former case than in the latter.

Coffee substitutes, C. D. WOODS and L. H. MERRILL (*Maine Sta. Bul. 65, pp. 103–107*).—The composition of 8 sorts of cereal coffee is reported and the food value of this class of goods discussed. It was found that, as claimed, the samples examined were free from true coffee. The infusion did not have a high food value, containing, when made according to directions, from one-third to one-twentieth as much solid matter as skim milk.

Inspection and analyses of foods, M. A. SCOVELL (*Kentucky Sta. Bul. 86, pp. 51*).—As an aid to the interpretation of the Kentucky pure-food law, a number of provisional definitions of food materials and articles used in their preparation are suggested, and the analyses made in accordance with the law are reported of 727 samples of dairy products, spices, flour, vinegar, etc. Of these, 290 were found to be adulterated.

Fodders and feeding stuffs, F. T. SHUTT (*Canada Expt. Farms Rpts. 1899, pp. 143–147*).—Analyses are reported of broad-leaf hay (*Spartina cynosuroides*), hay tea, cotton-seed meal, the seed of lamb's-quarters (*Chenopodium album*). The latter had the following percentage composition: Water, 9.82; fat, 6.78; protein, 14.19; carbohydrates, 63.91; crude fiber, 1.27, and ash, 4.03. Judged by composition only, the author believes the seed "to have a comparatively high feeding value. Its percent-

ages of fat and protein—the two most important nutrients—place it approximately midway between corn meal and bran. Since these seeds are very small and possess a hard integument, it seems most probable that if fed without previous grinding or boiling the greater number of them would pass through the animal undigested, in which case not only would they be of no food value, but harm would be done by their dissemination over the farm in the resulting manure."

Feeding-stuff inspection, C. D. WOODS and J. M. BARTLETT (*Maine Sta. Bul. 63, pp. 75–88*).—Analyses of feeding stuffs made in accordance with the State law are reported, the constituents determined being protein and fat. The materials examined include cotton-seed meals, gluten meals, linseed meals (old and new process), corn-and-oat feeds, oat chop, oat feeds, dairy feeds, poultry food, rice feed, mixed feeds of different sorts, animal meal, beef scraps, ground beef scraps, ground beef cracklings, and a raw ground bone meal.

Rice flour and bran as a feeding stuff, C. DUSSERRE (*Chron. Agr. Canton Vaud, 13 (1900), No. 16, pp. 472–474*).—The value of these feeding stuffs is discussed.

Potato pomace, J. M. BARTLETT (*Maine Sta. Bul. 65, pp. 115, 116*).—Two analyses of potato pomace (the residue from the manufacture of starch) are reported.

The employment of the residue from wine making as a feeding stuff, S. BIELER (*Chron. Agr. Canton Vaud, 13 (1900), No. 16, pp. 374–377*).—A discussion of the methods of preserving and feeding the residue from wine making.

Feeding nonsaccharine sorghums, C. E. MEAD (*New Mexico Sta. Bul. 33, pp. 46, 47*).—Brief statements are made concerning a practical test of the feeding value of brown durra, red and white Kafir corn, black rice corn, large African millet, and yellow millo maize forage. In general, satisfactory results were obtained.

Concerning the formation of glycogen from protein, B. SCHÖNDORFF (*Arch. Physiol. [Pflüger], 82 (1900), No. 1–2, pp. 60–85*).—On the basis of experiments with frogs fed casein, the author concludes that glycogen can not be formed in the body from a proteid which does not possess a carbohydrate group.

The relation of nitrogen to chlorids in the stomach contents during digestion, J. WINTER and FALLOISE (*Compt. Rend. Acad. Sci. Paris, 130 (1900), No. 24, pp. 1646–1648*).

On the relation of the reducing power of normal urine to the amount of certain nitrogen contents present, J. H. LONG (*Jour. Amer. Chem. Soc., 22 (1900), No. 6, pp. 309–327*).—The reducing power of uric acid and creatinin in relation to the total reducing power of urine was investigated.

Concerning the substances in the blood soluble in ether, R. WEIGERT (*Arch. Physiol. [Pflüger], 82 (1900), No. 1–2, pp. 86–100*).—Artificial digestion experiments are reported. In the author's opinion his experiments show that blood contains a substance soluble in ether which is not fat.

Concerning digestion in birds, L. PAIRA-MALL (*Arch. Physiol. [Pflüger], 80 (1900), No. 11–12, pp. 600–627*).—An experimental study of the physiology of digestion in birds, with a critical review of the literature of the subject.

Steers, J. H. GRISDALE (*Canada Expt. Farms Rpts. 1899, pp. 54–58, pls. 3*).—The gains made by 8 lots of 4 steers each during a period of 16 weeks are tabulated, together with the cost of the gain and the net profit. No conclusions as to the relative effects of the different rations are given. The gains made by 29 steers fed in the spring are briefly reported. On a ration of silage, hay, and mixed grain the average daily gain was 2.06 lbs. Brief statements are also made concerning feeding tests made with steers in 1900.

Steer feeding experiments, 1898–99, R. ROBERTSON (*Canada Expt. Farms Rpts. 1899, pp. 252–254*).—A test of the comparative value of different breeds of steers at the Nappan Experimental Farm is briefly reported. They were fed from December 1 to March 16 such feeding stuffs as mixed meal, turnips, silage, hay, and straw. Four

Polled Angus steers gained 965 lbs.; 4 Herefords gained 805 lbs.; 4 Shorthorns, 760 lbs.; and a second lot of 4 Shorthorns, 675 lbs., while 4 scrubs gained 755 lbs.

Cattle, S. A. BEDFORD (*Canada Expt. Farms Rpts. 1899, pp. 311, 312*).—Brief statistics are given of the Brandon Experimental Farm herd, and of a test made with 2 lots of 3 grade Shorthorn steers each as to the comparative value of wheat and oat straw. The steers were fed for 110 days, silage and chopped grain being given in addition to the straw. During the last 55 days flaxseed was also fed. They were purchased at 3 cts. and sold for 4.85 cts. per pound. The average daily gain per head of lot 1 (fed wheat straw) was 1 lb. 3 oz. and of lot 2 (fed oat straw) 1 lb. 1 oz., the profits on the 2 lots being $20.11 and $19.64, respectively.

Cattle, A. MACKAY (*Canada Expt. Farms. Rpts. 1899, pp. 383-385*).—Barley, oat, and wheat straw, and native and brome grass hay, when fed in addition to silage and meal, were compared with 5 lots of steers at the Indian Head Experimental Farm. The lots fed straw contained 4 animals and those fed hay 2 animals each. In 4 months the gain per steer on the different rations was 126.25, 91.66, 162.5, 127.5, and 180 lbs., respectively. In every case the cost of a pound of gain was 7 cts.

Sheep fattening experiments in 1899, J. GRUDE (*Tidsskr. Norske Landbr., 7 (1900), No. 2, pp. 77-85*).—A test with 2 lots of 100 lambs each to compare linseed cake and oats when fed with hay and turnips showed that in 30 days on the former ration the gain per lot was 399.5 kg. and on the latter 320 kg. On account of the high price of the oil cake, oats were considered the more economical feed.—F. W. WOLL.

Experimental pig feeding, J. MAHON (*Queensland Agr. Jour., 7 (1900), No. 1, pp. 23, 24*).—In a test with 2 lots of 4 pigs each on the value of molasses added to a ration of ground barley, the amount of food required per pound of gain by the lot fed barley was 5.5 lbs., and the amount required by the lot fed barley and molasses was 5.08 lbs.

Some experiments in pig feeding (*Jour. Bd. Agr. [London], 7 (1900), No. 1, pp. 28-33*).—A discussion of experiments by Campbell at Yorkshire College, Leeds, and by Harris at Calne. The latter were made with the aid of the Wilts County Council and other local assistance.

Pigs, J. H. GRISDALE (*Canada Expt. Farms Rpts. 1899, pp. 60-62*).—Brief statements are made concerning the pigs kept and the feeding tests carried on. In a test of the value of rape, begun August 2, 6 pigs were fed until November 30 and 5 until December 29 on a quarter of an acre plat of rape, and during part of the time were given some grain or mangolds also. The 2 lots produced 1,434 lbs. of pork, the cost of a pound of gain being 3.42 cts. According to the author this is materially less than the average cost of pork produced on grain alone.

Swine, R. ROBERTSON (*Canada Expt. Farms Rpts. 1899, pp. 255, 256*).—The author gives details of the work of the year with swine at the Nappan Experimental Farm. When fed an average of 20 lbs. per head daily of skim milk in addition to meal, 3 Berkshire pigs, weighing 77 lbs. at the start, gained 358 lbs. in 110 days. Three Berkshires, weighing 216 lbs. at the start and fed on an average of 25 lbs. daily of skim milk in addition to meal, in 125 days gained 469 lbs. In 165 days 4 Yorkshires weighing 132 lbs. at the start and fed the same ration gained 768 lbs. A test from which definite conclusions were not drawn is also reported on the comparative value for pigs of wheat shorts, buckwheat, corn meal, and crushed oats, 2:1, and pea meal and crushed oats, 2:1. Corn meal and pea meal made firm pork, that of the pigs fed corn meal being slightly more satisfactory. Pork made from buckwheat was soft.

Swine, S. A. BEDFORD (*Canada Expt. Farms Rpts. 1899, pp. 312, 313*).—The Brandon Experimental Farm herd of swine is described as well as a test on the value of coarse grain with a small proportion of bran for pigs. Four Berkshire pigs fed bran, oats, and barley in about the proportion of 1:7:2 gained 166 lbs. in the 11 weeks of

the first period at a cost of 2.76 cts. per pound. During a second period of 4 weeks there was a gain of 84 lbs. at a cost of 2.42 cts. per pound, on a ration of bran, oats, and barley 1:1:2. In a third period of 5 weeks the gains amounted to 126 lbs., the cost of a pound of gain being 1.98 cts. The grains were fed in the same proportion as during the second period. The financial side of the test is also discussed.

Poultry, S. A. Bedford (*Canada Expt. Farms Rpts. 1899, pp. 314, 315*).—The advantage of a long and a short period of fattening was studied with cockerels and ducks at the Brandon Experimental Farm. Eight cockerels weighing 28 lbs. 12 oz., fed a mixture of equal parts of ground oats, wheat, and barley, mixed with water to the consistency of thin porridge, gained 6 lbs. 1 oz. in 21 days, the cost of a pound of gain being $3\frac{1}{3}$ cts. In a second period of 14 days the gains amounted to 4 lbs. and the cost of a pound of gain was 7 cts. Five crossbred Pekin ducks under a year old were confined in a yard and fed well-moistened chopped wheat, oats, and barley, 1:1:1. They were given some vegetable matter such as cabbage and turnip leaves and supplied with water. The ducks weighed 23 lbs. 2 oz. at the beginning of the test. In 24 days they gained 5 lbs., the cost of a pound of gain being $8\frac{1}{4}$ cts. During the second period, which covered 9 days, there was a gain of 15 oz., the cost of a pound of gain being $17\frac{1}{5}$ cts.

Preservation of eggs, F. T. Shutt (*Canada Expt. Farms Rpts. 1899, pp. 223–226*).—The author reports comparative tests of the value of limewater, water glass, glycerin, and distilled water for preserving eggs. Some eggs were also coated with paraffin and kept in bottles. The experiment demonstrated, in the author's opinion, "the value of saturated limewater as an egg preservative. As far as our experience goes, no other fluid is its equal, the eggs from this preservative being far and away superior to those kept by the other methods here stated."

DAIRY FARMING—DAIRYING.

Feeding experiments with palm-nut cake, palm-nut residue, linseed meal, castor-bean meal, and peanut meal for milch cows, E. Ramm, C. Momsen, and T. Schumacher (*Milch Ztg., 29 (1900), Nos. 19, pp. 291–294; 20, pp. 309–311; 22, pp. 340, 341; 23, pp. 353–355, figs. 4*).—These feeding stuffs, fed in like quantities in rations otherwise identical, were compared in tests with 6 cows, covering in all a period of about 3 months. The tests proper lasted 4 days each and were preceded by preliminary periods varying from 6 to 11 days. The peanut ration was tested in the first and seventh periods, the palm-nut cake in the second and fourth, and the others in intermediate periods. Some of the principal results are shown diagrammatically, and are summarized in the following table:

The yield and quality of milk and butter fat from cows fed different rations.

Ration.	Yield of milk per 1,000 kg. live weight per day.	Yield of fat per 1,000 kg. live weight per day.	Fat content of milk.	Solids-not-fat in milk.	Iodin absorption number of fat.
	Kg.	*Kg.*	*Per cent.*	*Per cent.*	
Peanut meal	27.35	0.91	3.38	8.78	37.2
Palm-nut cake	24.09	.98	4.14	8.52	27.5
Palm-nut residue	24.23	.91	3.82	8.94	27.7
Linseed meal	28.31	1.03	3.71	8.82	47.2
Castor-bean meal	23.79	.79	3.38	8.76	47.1

The castor-bean meal, tested as a new feeding stuff, contained only 1.23 per cent of fat. This material is prepared by a patented process in which, according to a statement by the firm furnishing the meal for the test, all traces of injurious properties are removed. The material was costly as compared with other feeding stuffs, and the results of the test showed that it was not well suited for feeding dairy cows.

Influence of intervals between milkings on quality of milk, A. W. Stokes (*Dairy, 12 (1900), No. 143, pp. 319, 320*).—A herd of 21 cows was milked at 4 a. m. and 1 p. m., making the intervals between milkings, therefore, 9 and 15 hours respectively. Samples of the milk of each cow were taken at both milkings on August 4, 10, and 24, and September 11, and analyzed. Analytical data for 2 milkings at the beginning and end of the test are given. Sixteen of the cows gave milk on one or more occasions having less than 3 per cent of fat or less than 8.5 per cent of solids-not-fat. Of the 84 samples taken at the 1 o'clock milkings none contained less than 3 per cent of fat. Nine cows, however, gave milk containing less than 8.5 per cent of solids-not-fat. Of the 84 samples of morning's milk, 17 contained less than 3 per cent of fat and 19 less than 8.5 per cent of solids-not-fat. The milk drawn after the long interval was therefore poorer in quality than that drawn after the short interval. "It would seem as if the cows, as it were, took toll of it and reassimilated from it parts that they required for their own sustenance, if the milk were not drawn off at certain intervals."

Investigations of milk from mountain pastures (Satermelk), B. Ramstad (*Aarsber. Offent. Foranst. Landbr. Fremme, 1899, pp. 349–361*).—The milk produced by cows on mountain pastures has the reputation of being richer in fat and more palatable than the winter milk, due possibly to its deep yellow color. Goats' milk, on the other hand, retains its bluish-white color when produced in the mountains. Investigations by V. Dircks in the seventies showed, as the average of a large number of determinations, a daily yield of 4.3 liters of milk per cow on mountain pastures, with an average fat content of 3.9 per cent. In further study of this subject the author visited 7 mountain dairies (*säters*) in different parts of the interior of Norway, measured the milk of the cows in the various herds, and made separate analyses of the morning and evening milkings of each cow for 2 days. Samples of the mixed herd milk of the goats were also taken and analyzed.

The evening's milk was generally lower in fat than the morning's milk, the difference in some cases amounting to 2 per cent. The average percentage of fat in cows' milk was 3.807 per cent, agreeing closely with Dircks' figures, and also with the average of analyses of milk produced in the neighboring valleys during the same time of the year (July and August, 1898), which was 3.77 per cent.

The altitude of the pastures and their quality and location do not

seem to have an appreciable influence on the fat content of the milk. The same observation was made in the case of the milch goats.—F. W. WOLL.

The germ content of milk, O. APPEL (*Molk. Ztg., 14 (1900), No. 17, pp. 277, 278*).—Experiments were made to determine the presence or absence of bacteria in the cow's udder. In one series of the experiments milking tubes were used and in another the milk for examination was drawn directly into flasks. Determinations were made of the number of bacteria present in samples of milk taken at the beginning, twice during the process, and near the end of milking. In the second series of experiments germ-free milk was obtained near the end of milking. The decrease in the germ content of the milk during milking was less marked when milking tubes were used. The introduction of the tube was thought to carry germs into the interior of the udder. Pure cultures of *Bacterium lactis aërogenes* and other bacteria were added to sterile milk and injected into the udder. A swelling of the udder and marked changes in the milk followed such inoculation. No bad effects were observed as a result of injecting sterile milk or water. The different experiments are considered as showing that bacteria are not normally present in the udder. The author also discusses the number and character of the germs found in milk and their destruction by heat.

Examination of butter color, F. H. WERENSKIOLD (*Aarsber. Offent. Foranst. Landbr. Fremme, 1899, pp. 162, 163*).—The author examined 9 samples of butter color, of which number 6 gave no reaction for aniline color and 3 were pure annatto color. The following method of determining the strength of color was used: A standard solution of 1 gm. potassium bichromate dissolved in a liter of distilled water was placed in a Hehner colorimeter; 0.5 cc. of the butter color was dissolved in 100 cc. of petroleum ether and compared with the standard solution. From 48 to 64 cc. of the aniline-free butter colors was required to give the same tint as the standard solution, while in case of the aniline colors from 31.3 to 50.3 cc. was required.—F. W. WOLL.

Experiments with calcium chlorid for rendering heated milk suitable for cheese making, KLEIN and A. KIRSTEN (*Milch Ztg., 29 (1900), Nos. 12, pp. 177–179; 13, pp. 196–199; 14, pp. 210–213; 16, pp. 242–245; 17, pp. 258, 259*).—A brief summary is given of an investigation previously noted (E. S. R., 10, p. 1092), and 5 series of experiments in continuation of that work are reported in detail.

The present investigation included in all 56 trials with skim milk and 2 with whole milk. Of this number 18 were control tests with unheated milk. In the remainder the milk was heated to 85° C. for 10 minutes, to 85–90° for 15 minutes, or to 100° for 2 minutes, and calcium chlorid equivalent to 25 gm. of calcium oxid per liter of milk was added. In different experiments after heating and cooling and

before adding the calcium chlorid and rennet. 2½ per cent of the milk was replaced by skim milk which had been kept at 40° C. for 1 to 2 hours or by skim milk to which different pure cultures had been added; 5 per cent was replaced by fresh whole milk; or ¼ per cent was replaced by partly ripened cheese which was thoroughly powdered and mixed with the milk. In a large number of the experiments the curd was subsequently heated at 40 or 45° C. to hasten the separation of the whey and to increase the adhesiveness of the curd. The data for all of the experiments are given in tabular form and are discussed at some length.

The results in general agree with those obtained in the earlier experiments. By the use of calcium chlorid and pure cultures normal cheese of different kinds was made from skim milk and also from whole milk which had been heated at a high temperature. In 23 of the tests in which normal cheese was made from heated milk the average yield of ripe cheese was increased 32 per cent over that from unheated milk. The average increased yield of dry material in the cheese amounted to 12 per cent. This gain is considered more than sufficient to pay for the cost of heating and a clear profit where pasteurization is required. Heating at 100° increased the yield over heating at 85–90°, due to a more complete coagulation of the soluble casein. In none of the experiments was the subsequent heating at 45° sufficient to reduce the percentage of whey in the curd or ripe cheese to that in cheese made from unheated milk.

A sour milk cheese of normal quality was prepared from heated milk to which 10 per cent of sour milk was added without the use of calcium chlorid. This is noted as essentially the same result as that secured by Hamilton (E. S. R., 12, p. 288).

Evolution and development of the dairy cow, KATE M. BUSICK (*Amer. Cheesemaker, 15 (1900), No. 177, pp. 6, 7*).—A general discussion.

Studies on the milk production of individual cows, F. HÜBNER (*Molk. Ztg., 14 (1900), No. 26, pp. 437–440*).—A monthly record of 40 cows for one year is given, with a summary of the principal data and notes on the management of the herd.

Feeding experiment with palm-nut residue, P. VIETH (*Milch Ztg., 29 (1900), No. 19, pp. 294, 295*).—In an experiment with 6 cows, covering 4 periods of 10 days each, the residue from the manufacture of oil from palm nuts was compared with an equal quantity of a mixture of cotton-seed meal and bran (1:3) in rations otherwise alike. The results as regards both the total yield of milk and the yields of fat and solids were slightly in favor of the ration containing the palm-nut residue. The cost of the palm-nut residue was also 4 per cent cheaper than that of the contrasted feeding stuffs.

Value of molasses as food, P. HOPPE (*Ztschr. Ver. Deut. Zuckerind., 1900, No. 535, II, pp. 713–762; abs. in Jour. Chem. Soc. [London], 78 (1900), No. 456, II, p. 681*).—In experiments with cows, 5 kg. of molasses per day was fed without injury to digestion. As a rule, the milk yield was increased, although the percentage of fat was distinctly diminished.

Record of dairy herd, R. ROBERTSON (*Canada Expt. Farms Rpts. 1899, pp. 250–252*).—A record of 31 cows for one year, showing yield and fat content of milk, cost of feed, etc. The profit from individual cows ranged from $2.68 to $27.83.

How to distinguish between good and bad milk, E. H. FARRINGTON (*Amer. Cheesemaker, 15 (1900), No. 177, p. 4*).—A description of the Wisconsin curd test.

Human milk, E. F. LADD (*Sanitary Home, 2 (1900), No. 8, pp. 181–183*).—Analyses are given of 11 samples. The fat content varied from 1.5 to 7.32 per cent and the casein from 0.63 to 2.66 per cent.

Notes on the purification of milk, O. KRÖHNKE (*Milch Ztg., 25 (1900), No. 23, pp. 356, 357*).—A discussion of different methods.

Contamination of dairy produce and its causes, G. S. THOMSON (*Jour. Agr. and Ind., South Australia, 4 (1900), No. 3, pp. 257–263*).—This is a general discussion of the subject. The appearance of cultures made from moldy cream and butter, dirt from hands of milker, sterilized and contaminated milk and cream, good and impure factory water, etc., is shown in plates. Different micro-organisms found in milk are also figured. Notes are given on colostrum milk and its detection.

Cream ripening by direct inoculation, A. ZOFFMANN (*Milch Ztg., 29 (1900), No. 17, pp. 259, 260*).—The author notes the preparation of a pure culture for adding directly to cream, thereby avoiding the trouble required in preparing the usual starter. One hundred grams of the author's culture ripened about 250 liters of pasteurized cream in 16 to 20 hours. In 4 comparative tests, the yield of butter is reported as considerably increased and the quality noticeably improved by the use of the author's culture as compared with the use of a buttermilk starter.

Butter, A. M. PETER (*Kentucky Sta. Rpt. 1898, pp. XIII–XV*).—Tabulated analyses showing content of fat, water, salt, and curd are given of 140 samples of butter made at the station in churn tests of 7 Jersey cows.

Nevada butters, N. E. WILSON (*Nevada Sta. Bul. 42, pp. 13, dgm. 1*).—Brief notes are given on butter and its composition and analyses of 7 samples of creamery butter and 9 of dairy butter from different parts of the State are reported in tables and also diagrammatically. The results are compared with analyses of Connecticut dairy and creamery butter, California butter, and butter exhibited at the American Dairy Show at Chicago in 1882. The average composition of the samples of butter analyzed was as follows: Dairy butter—water 10.75, fat 84.74, casein 1.24, and ash 3.07 per cent; creamery butter—water 12.27, fat 83.47, casein 1.18, and ash 2.77 per cent.

Grading butter and its educational value, G. S. THOMSON (*Jour. Agr. and Ind., South Australia, 4 (1900), No. 3, pp. 263–265*).—Notes are given on the system of grading butter employed in South Australia.

Loss due to bad flavor, gas, and overripe milk, H. H. DEAN (*Amer. Cheesemaker, 15 (1900), No. 177, p. 1*).—Contains suggestions on cheese making with brief statements of results of experiments at the Ontario Agricultural College.

Influence of salt on the color of butter, A. V. BRANTH (*Milch. Ztg., 29 (1900), No. 17, p. 265*).—Several experiments are briefly reported in which the discoloration of butter was considered due to chemical impurities in the salt.

Microbes in cheese making, H. W. CONN (*Pop. Sci. Mo., 58 (1900), No. 2, pp. 148–155*).—A general discussion of the ripening of soft and hard cheese. Problems for investigation along this line are pointed out.

Cheese making, J. W. DECKER (*Columbus, Ohio: J. W. Decker, 1900, pp. XIII + 192, pls. 25, figs. 43*).—This is intended primarily as a text-book and embraces a second revision of the author's work on Cheddar cheese making, and in addition a discussion of the manufacture of Swiss, brick, Limburger, Edam, and cottage cheese. References to original publications are given.

VETERINARY SCIENCE AND PRACTICE.

Tuberculin experiments in cattle, F. HUTYRA (*Ztschr. Tiermed.*, *4* (*1900*), *No. 1*, *pp. 1–27*).—The author believes that in the application of the tuberculin test it is quite sufficient to take the body temperature only once before inoculation with tuberculin. After inoculation it is not necessary to take the temperature until the ninth hour, and then every 3 hours rather than every 2 hours. All animals are to be considered as tuberculous which show a temperature reaction of 1.5° C. after injection with tuberculin; also all animals which show a temperature reaction of 1 to 1.4° C., accompanied with other clinical symptoms. On the other hand there is no good reason to condemn animals when the temperature reaction is not greater than 1.4° C. and is unaccompanied with other clinical symptoms, provided that a careful examination of the animals has not disclosed any pathological changes or clinical evidence of tuberculosis.

The author has brought together in tabular form the clinical records of a large number of animals upon which experiments were made.

Experiments in feeding tuberculous milk, meat, and various organs, V. GALTIER (*Jour. Méd. Vét. et Zootech.*, *5. ser.*, *4* (*1900*), *pp. 1–5*).—An emulsion prepared from 2 spleens and 2 lungs of tuberculous rabbits was mixed with a liter of cow's milk. This mixture was filtered and divided into 4 equal parts. One part was not heated, while the other 3 parts were subjected for 6 minutes to temperatures of 70, 80, and 90° C., respectively. Four guinea pigs which were inoculated with the unheated milk died of generalized tuberculosis. Of the 4 guinea pigs which were inoculated with milk heated to 70°, 3 showed tuberculous lesions, and were killed on the fifth day after inoculation. On the same day one of the 4 guinea pigs which had been inoculated with milk heated to 80° showed tuberculous lesions, while the 4 which had been inoculated with milk heated to 90° were all healthy.

Several other similar experiments were conducted by the author, the results of which may be stated as follows: Milk is not thoroughly sterilized by subjection for 6 minutes to temperatures of 70, 75, 80, or 85° C. Exposure to these temperatures for 6 minutes only attenuated to a slight extent the virulence of the tubercle bacillus, and tuberculosis is produced by inoculation of even small doses of milk so treated. Exposure to a temperature of 75° for 20 minutes is not sufficient to destroy all the tubercle bacilli.

Feeding experiments were conducted by the author upon young pigs with tuberculous material which had previously been sterilized in an autoclave at 110° C. As a result of these experiments the author concludes that the consumption of tuberculous organs which have previously been sterilized does not produce poisoning or tuberculosis even when taken in considerable quantities and repeatedly.

Poisoning from ground sesame cakes, DEYERLING (*Deut. Thierärztl. Wchnschr., 8 (1900), No. 9, pp. 73, 74*).—The author makes a report upon the symptoms and circumstances of poisoning in the case of 111 cattle from eating ground sesame cake. The animals had previously been fed small quantities of this substance, together with other fodder materials. At 5 o'clock in the afternoon all these animals received 1⅓ lbs. of ground sesame cake in the place of cotton-seed meal. The animals also received quantities of sugar-beet leaves and hay and straw. About 15 minutes after feeding one animal was observed to be bloated, and within a short time all the animals manifested the same symptoms. These symptoms included tympanites, coughing, and difficult breathing. The animals all recovered.

In order to make sure that the ground sesame cake was the cause of the trouble the author obtained permission to experiment further with this substance. A few of the animals were fed ground sesame cake in addition to the regular ration which all received. The same symptoms were developed as before.

African horse sickness, J. MCFADYEAN (*Jour. Comp. Path. and Ther., 13 (1900), No. 1, pp. 1-20*).—The author makes a report on 14 experiments for the study of the symptoms, etiology, and treatment of this disease. It was shown that the pathogenic organism readily passes through the pores of the Berkfeld or Chamberland F. filter, even when they are suspended in liquids containing a considerable amount of albumin. The experiments carried out by the author indicate that the disease may be transmitted to healthy horses by hypodermic inoculation with the fresh blood of a diseased horse, and also by introducing the material into the stomach. It would appear that under normal conditions the disease is most frequently transmitted by ingestion of the virus. So far as the author's observations go, it seems probable that the disease is not ordinarily acquired by inhalation.

The pathogenic organism of this disease has been called œdemamyces and has been believed to be a facultative parasite which is able to multiply rapidly outside of the animal body under favorable conditions of heat and moisture. It is believed by some that the organism is frequently taken into the body by eating dew-laden grass, but there is very little evidence to sustain this belief.

An elevation of temperature is the first symptom of infection by the African horse sickness. This rise of temperature takes place in from 4 to 7 days after inoculation and is not accompanied by rigor. In 5 cases of the disease produced experimentally, death occurred on the eighth day. The duration of the disease appeared to be the same in cases produced by inoculation and in those produced by ingestion of the virus. Detailed notes are given on the pathological anatomy in cases of death from this disease.

Immunization against rabies by means of normal nerve tissue, A. AUJESZKY (*Centbl. Bakt. u. Par., 1. Abt., 27 (1900), No. 1, pp. 5–10*).—Two dogs, weighing 6 and 5.5 kg., respectively, received a hypodermic injection daily from January 24 to February 11 of 10 cc. of an emulsion which had been prepared from the spinal cord of healthy cattle, in normal salt solution. On February 15 the dogs were inoculated in the ear with rabies virus. Injections were continued until February 25, so that each dog during the course of 34 days received 30 gm. of spinal cord. The control rabbit died on the thirty-fifth day, while the dogs remained healthy.

Three dogs, weighing 8, 8.7, and 6.5 kg., respectively, received injections of normal nerve tissue as in the previous experiment. Ten days after the beginning of these injections they were inoculated in the ear with rabies virus. The dogs showed symptoms of rabies sooner than the control animals.

Three other dogs, weighing 6, 8, and 5 kg., respectively, received injections of nerve substance as in the other experiments. When inoculated with laboratory rabies virus, the dogs remained well, but the control animal was also unaffected. When bitten by a rabid dog, all showed symptoms of the disease within a short time.

From these investigations it is concluded that hypodermic injections with emulsions of normal nerve tissue are not sufficient to protect animals against the more virulent rabies virus. In the first-mentioned experiments, where this method seemed to be sucessful, the virulence of the rabies virus was not determined, and it is possible that it was not strong enough to produce rabies.

The prophylaxis of malarial fever by means of protection against mosquitoes, E. DI MATTEI (*Centbl. Bakt. u. Par., 1. Abt., 28 (1900), No. 6–7, pp. 189–195*).—An experiment was conducted by the author on 4 men in Catania for the purpose of determining whether malarial fever could be contracted without the agency of mosquitoes. The 4 men who submitted to the experiment slept in an exceedingly malarial district for 32 nights with doors and windows open, but covered with close netting which prevented the entrance of all mosquitoes, and no case of malaria developed in any of the 4 men.

The influence of tetanus toxin on the central nervous system, M. JOUKOWSKY (*Ann. Inst. Pasteur, 14 (1900), No. 7, pp. 464–478, pl. 1*).—In cases of poisoning from tetanus toxin, modifications in the nerve cells of the medulla and to a certain extent in those of the cerebrum are to be noted. The modifications of the cell nuclei are variable and can not be considered characteristic of this disease. Another pathological condition is more uniformly observed and consists in the accumulation of mononuclear migratory cells around the nerve cells. These migratory cells penetrate the protoplasm of the nerve cells, especially in the anterior group of cells of the anterior cornua. This phenomenon is to be considered as a phagocytosis.

Text-book of special pathology and therapy of domesticated animals, F. FRIEDBERGER and E. FRÖHNER (*Lehrbuch der speciellen Pathologie und Therapie der Hausthiere. Stuttgart: Ferdinand Enke, 1900, 5. ed., vol. 1, pp. 867*).—This volume contains an elaborate discussion of the various diseases of the digestive organs, liver, diaphragm, spleen, urinary and genital organs, heart and larger blood vessels, skin, locomotor organs, and nervous system.

Analyses of urine for the detection of antipyretics, A. PETERMANN (*Bul. Sta.

Agron. Gembloux, 1900, No. 68, pp. 9–11).—The veterinary service having heard rumors of the fraudulent use of antipyretics for the purpose of preventing the reaction of cattle to the tuberculin test undertook the analysis of the urine of tested animals for the purpose of determining whether such substances had been used fraudulently or not. Salicylate of soda and salol are the substances which have thus far been detected and they were present in the urine in the form of salicylic acid. For the purpose of coming to more definite conclusions in this matter further investigations will be made on antipyrin and coloring matters in the urine.

Changes in the kidneys during pulmonary tuberculosis in relation to the excretion of the tubercle toxin and the tubercle bacillus, G. D'ARRIGO (*Centbl. Bakt. u. Par., 1. Abt., 28 (1900), No, 8–9, pp. 225–228*).—During pulmonary tuberculosis it was found that alterations were produced in the blood vessels, interstitial connective tissues, glomeruli, and epithelium of the kidneys. At first the tubercle toxin is present only in small quantities and is not accompanied by the tubercle bacillus, but after pathological changes have been produced in the kidneys by the action of the toxin the tubercle bacillus soon invades the kidneys and may in many instances be the primary cause of death.

Transmission of tuberculosis through the meat and milk supply, J. J. REPP (*Reprint from Philadelphia Med. Jour., 1900, Aug. 11, pp. 22*).—The author presents a critical account of the literature relating to the transmission of tuberculosis from animal to animal and from animal to man by means of meat, artificial inoculation, milk supply, and other natural methods. The author believes that the results thus far obtained indicate that tuberculosis may be transmitted to the lower animals by the ingestion of tuberculous meat or milk and that the meat and milk of certain tuberculous animals contain living virulent bacilli.

Acceleration in the culture of the tubercle bacillus, W. HESSE (*Centbl. Bakt. u. Par., 1. Abt., 28 (1900), No. 8–9, pp. 255–257*).—A controversial article regarding the method already proposed by the author for the speedy cultural diagnosis of 'the tubercle bacillus.

Texas fever in the South, R. W. CLARK (*Farm Students' Rev., 5 (1900), No. 10, p. 149*).—A brief discussion of the nature of Texas fever and of the great economic importance of immunization methods against this disease.

The prevention of Texas cattle fever and the amended laws controlling contagious and infectious diseases, C. MCCULLOCH (*Virginia Sta. Bul. 104, pp. 165–180, fig. 1*).—This bulletin contains a brief review of the experimental work done on the cattle tick and Texas fever by the Bureau of Animal Industry of this Department and the agricultural experiment stations in Texas, Missouri, and Louisiana. Appended to this review is a copy of the act of the general assembly of Virginia providing for the protection of domestic animals and for the establishment of quarantine laws, rules, and regulations.

Blackleg: Its nature, cause, and prevention, V. A. NÖRGAARD (*U. S. Dept. Agr., Bureau of Animal Industry Circ. 31, pp. 22*).—This circular is an abstract of the author's article on the same subject in the Fifteenth Annual Report of the Bureau (E. S. R., 10, pp. 991–993).

Blackleg vaccine, E. P. NILES (*Virginia Sta. Bul. 103, pp. 153–163, figs. 2*).—A revision of Bulletin 90 of the station (E. S. R., 11, p. 494).

The Cyprus sphalangi and its connection with anthrax, G. A. WILLIAMSON (*British Med. Jour., 1900, No. 2070, pp. 558–561, figs. 7*).—The insects called sphalangi in Cyprus belong to the genus Mutille. A number of cases of anthrax in man are reported by the author, with accounts of the circumstances surrounding the cases. The author believes that the anthrax bacillus is frequently carried upon the sphalangi insects, and that human beings may become inoculated with the disease either from the bites of the infected insects or from their contact with wounds.

Variations in the power of anthrax bacillus in liquefying gelatin, T. MATZUSCHITKA (*Centbl. Bakt. u. Par., 1 Abt., 28 (1900), No. 10–11, pp. 303, 304*).—Cul-

tures of anthrax bacillus which had been maintained for $1\frac{1}{2}$ years upon a 10 per cent gelatin medium at the living temperature, and which had been transferred at intervals of 2 or 3 months during this time, lost the power of liquefying gelatin to such an extent that this process took place only to a slight degree after 50 days. The anthrax cultures which had lost this characteristic of liquefying gelatin remained as virulent as other anthrax cultures. The power of liquefying gelatin gradually returned after 4 to 6 transfers upon agar medium at a temperature of 37° C.

The practical working of regulations for combating foot and mouth disease (*Arch. Deut. Landw. Raths, 24 (1900), pp. 243-274*).—After a discussion of the problem at the twenty-eighth meeting of the German Agricultural Commission, it was resolved that the present regulations regarding this disease are not well adapted to prevent the spread of the disease, and that at the same time they work unnecessary hardships upon certain stock owners and shippers. It was further resolved that a commission be selected to report upon more suitable regulations regarding this matter.

Contribution to the study of antileucocyte serums—their action upon the coagulation of blood, C. DELEZENNE (*Compt. Rend. Acad. Sci. Paris, 130 (1900), No. 14, pp. 938-940*).—The author's experiments were conducted on dogs and rabbits. It was found that the antileucocyte serum when mixed with the blood of the dog in a glass vessel hastened the process of coagulation. When injected directly into the circulation the serum had the opposite effect.

Antirabies vaccinations at the Pasteur Institute in 1899, E. VIALA (*Ann. Inst. Pasteur, 14 (1900), No. 7, pp. 487-491*).—Brief notes on the history of the 1,614 cases treated, including observations on the rabid animals.

A parasite the supposed cause of some cases of epilepsy, G. H. FRENCH (*Canad. Ent., 32 (1900), No. 9, pp. 263, 264, fig. 1*).—*Gastrophilus epilepsalis* is described as a new species, which was found in great numbers in the intestines of a boy suffering from epileptic spasms. After a prolonged anthelmintic treatment the boy recovered, and it is believed by the author that this species was the direct cause of epilepsy, It is not possible to determine in this case the origin of the infestation.

Statistics on parasites of slaughtered animals of European Russia, Siberia, and the Caucasus for 1896 and 1897, G. GURIN (*Izv. Moscow Selskokhoz Inst., 5 (1899), No. 3, pp. 254-283*).—These statistics are taken from the reports of 40 slaughterhouses and cover 1,959,688 cattle, 149,329 calves, 1,479,923 sheep, 510,842 hogs, and 13,036 horses. The most common parasite in all these animals was *Tænia echinococcus*. The liver fluke was the second most frequent in adult cattle, calves, and sheep. Other parasites which occurred with more or less frequency were *T. mediocanellata, T. denticulata, T. expansa, Strongylus paradoxus, S. micrurus, S. filaria, S. contortus, Ascaris megalocephala,* and *Trichina spiralis*.—P. FIREMAN.

Gregarines and the intestinal epithelium, L. LÉGER and O. DUBOSCQ (*Compt. Rend. Acad. Sci. Paris, 130 (1900), No. 23, pp. 1566-1568*).—The author made a study of the life history of gregarines in the alimentary tracts of insects. The study was principally confined to *Anthrenus musæorum* and *Gryllus domesticus*. In the intestines of the former species the gregarine *Pyxinia möbuszi* was found in abundance, while *Diplocystis major* was the common species in the intestines of the cricket. The author was unable to find these species inside the epithelial cells during any stage of their development.

Nodular disease of the intestines of sheep, D. HUTCHEON (*Agr. Jour. Cape Good Hope, 17 (1900), No. 2, pp. 89-91*).—The author made a study of this disease of sheep. It is stated that no remedies are known which will kill the embryo worms in the intestinal nodules and restore the intestines to a healthy condition. It is possible, however, to expel the worms from the intestines by the use of cathartic remedies.

Worms in sheep (*Jour. Agr. and Ind., South Australia, 4 (1900), No. 1, pp. 22-26.*)—Brief notes are given on nematode worms in lambs, together with a discussion of the more approved remedies for ridding lambs of these parasites, and methods of preventing infestation.

A biological note on Gastrophilus equi, J. Ericksson (*Ent. Tidskr., 21 (1900), No. 1, pp. 47, 48*).

Dehorning steers, J. H. Grisdale (*Canada Expt. Farms Rpts. 1899, pp. 58, 59*).—The author reports observations upon a number of steers which were dehorned. No definite statement is made as to the exact cost of dehorning, and no decided difference was noted in the effect of different instruments used in the process. These instruments were a saw and 2 forms of patented horn clippers. Some loss of weight was noted during the first few days succeeding the operation, and a corresponding loss of weight was observed in check animals, which were apparently worried by the action of the animals which were dehorned. All animals recovered their original weight within about a month.

A contribution to the study of so-called disinfectant soaps, with special reference to creolin soaps, C. Tonzig (*Extr. Gaz. Osp. e Clin., 21 (1900), No. 6, pp. 12*).—From experiments conducted with various soaps, to which different disinfectants had been added, the author concludes that simple soaps are not rendered any more effective by the addition of creolin, but that on the contrary they lose a portion of the disinfectant power which they possessed. Corrosive sublimate when added to soaps is transformed into the inert oleate and stearate of mercury, while boric acid and salicylic acid become transformed into soda and potash salts.

STATISTICS—MISCELLANEOUS.

Twenty-third Annual Report of Connecticut State Station, 1899 (*Connecticut State Sta. Rpt. 1899, pt. 3, pp. I–XV*).—These pages contain the organization list of the station, reports of the director and board of control, and a financial statement for the fiscal year ended September 30, 1899.

Eleventh Annual Report of Kentucky Station, 1898 (*Kentucky Sta. Rpt. 1898, pp. XXXIX+236*).—The report proper contains a list of officers of the station; a financial statement for the fiscal year ended June 30, 1898; a general review of station work by the director; and reports of the heads of the divisions of chemistry, entomology and botany, horticulture, and meteorology, parts of which are noted elsewhere. Reprints of Bulletins 72–79 of the station on the following subjects are appended: Potatoes—Tests with fertilizers (E. S. R., 10, p. 344), experiments for the control of potato scab (E. S. R., 10, p. 363); strawberries (E. S. R., 10, p. 355), the chinch bug (E. S. R., 10, p. 372), earthworms a source of gapes in poultry (E. S. R., 10, p. 393), commercial fertilizers (E. S. R., 10, pp. 336, 734; 11, p. 137), wheat (E. S. R., 10, p. 842), red rust of wheat (E. S. R., 10, p. 864), ginseng—its nature and culture (E. S. R., 10, p. 958).

The Maine Experiment Station, C. D. Woods (*Maine Sta. Bul. 62, pp. 45–74*).—This bulletin contains a brief historical and descriptive account of the station from its establishment in 1885, a summary of the more important experimental work undertaken, and lists of the subjects treated in the 15 annual reports and 61 bulletins issued by the station since its organization.

Twelfth Annual Report of West Virginia Station, 1899 (*West Virginia Sta. Rpt. 1899, pp. 45*).—A financial statement is given for the fiscal year ended June 30, 1899. A report of the director gives a general review of station work during the year and reports of the agriculturist and chemist review in greater detail the work of their respective departments. Reports of the entomologist and horticulturist are noted elsewhere.

A half century of agricultural experiments at Rothamsted, A. Ronna (*Ann. Sci. Agron., 1900, II, No. 1, pp. 139–160*).

The work of the society for agricultural education, W. J. Beal (*Science, n. ser., 12 (1900), No. 296, pp. 328–334*).—This is the president's address at the twenty-first meeting of the Society for the Promotion of Agricultural Science.

NOTES.

Alabama Canebrake Station.—W. Munford, of Uniontown, Ala., has been appointed a member of the board of control in place of S. H. Knight, deceased. The station has begun to print short articles in local newspapers. Experiments have been started for the purpose of getting a grass for winter pasturage.

Colorado Station.—F. M. Rolfs has been appointed assistant horticulturist to succeed Carl H. Potter. A. H. Danielson, B. S., of Wyoming, has been appointed assistant agriculturist and photographer of the station and A. F. Lindon, B. S., foreman of the farm.

Connecticut State Station.—George F. Campbell has resigned his position as chemist of the station and M. C. Williams has been appointed in his place.

North Dakota College and Station.—The large barn of the college and station was destroyed by fire January 4, resulting in the loss of considerable important data relating to feeding experiments. Feeding experiments will necessarily be suspended until a new barn can be erected. The barn and contents were insured.

Oklahoma College and Station.—The vacancy caused by the resignation of J. G. Kerr, assistant in agriculture in the college and station, has been filled by the appointment of J. S. Malone, B. S., a graduate of this college.

South Carolina Station.—A cottage for the station foreman has been completed. A two-story barn, 28 by 50 ft., and a building for fertilizers, with stalls for experiments with pigs underneath, have also been completed. A chemical investigation of rice, its products and by-products, has been partly completed, and the results will soon be issued in bulletin form.

Texas College and Station.—E. A. White, recently connected with the Baron de Hirsch School at Woodbine, N. J., has succeeded A. M. Ferguson as assistant in horticulture at the college and station.

Miscellaneous.—A recent report of the Somerset County (England) Education Committee, as noted in *Nature*, records the presentation by Lord Portman of an experimental farm 5 miles from Taunton, consisting of 142 acres, 80 of which are in pasture. The donor has made considerable alterations and additions to the farm buildings to adapt them to the requirements of the county committee. The primary object of the farm will be experiments on the profitable feeding of farm animals of different kinds, and incidentally experiments will be made on the improvement of land and the best method of growing various field crops.

In a review in *Nature* of the last report of the Woburn Experimental Fruit Farm, Dr. Maxwell Masters suggested the advantage of conducting such a series of experiments on poor soils also, so as to afford a basis for comparison. Following this suggestion, a control station has, according to *Nature*, been established on a relatively barren soil.

The first number has just been received of the new *Journal of Hygiene*, edited by Dr. George H. F. Nuttall, lecturer in bacteriology and preventive medicine in the University of Cambridge, England. It contains, among others, papers on Pathogenic microbes in milk, The red color of salted meat, Artificial modification of toxins, with special reference to immunity, and Studies in relation to malaria. The journal will appear quarterly and will be devoted mainly to original contributions.

O

EXPERIMENT STATION RECORD.

Editor: E. W. ALLEN, Ph. D., *Assistant Director.*

EDITORIAL DEPARTMENTS.

Chemistry, Dairy Farming, and Dairying—The Editor and H. W. Lawson.
Meteorology, Fertilizers and Soils (including methods of analysis), and Agricultural Engineering—W. H Beal.
Botany and Diseases of Plants—Walter H. Evans, Ph. D.
Foods and Animal Production—C. F. Langworthy, Ph. D.
Field Crops—J. I. Schulte.
Entomology and Veterinary Science—E. V. Wilcox, Ph. D.
Horticulture—C. B. Smith.
With the cooperation of the scientific divisions of the Department and the Abstract Committee of the Association of Official Agricultural Chemists.

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METEOROLOGY.

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FERTILIZERS.

FIELD CROPS.

AGRICULTURAL ENGINEERING.

STATISTICS—MISCELLANEOUS.

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EXPERIMENT STATION RECORD.

Vol. XII. No. 7.

The proceedings of the American Veterinary Medical Association for 1900, recently issued, contains a paper on the work of the veterinary section of the experiment stations, by Dr. John J. Repp, of the Iowa Station. This article is worthy of the thoughtful attention of those interested in the development or proper direction of the veterinary feature of experiment station work.

Dr. Repp has taken a census of the opinion of station veterinarians as to their true functions, the work which it is of most importance for them to do, and the general conditions pertaining to their departments. He finds the conditions far from satisfactory, or such as could reasonably be expected to materially advance the cause of veterinary science in very many instances. Only one station veterinarian has no other duties than station work, and in only two cases are the other duties light. In all other cases the burden of the work done is in some other line than that of station veterinarian. Most of the men are reported as being so loaded down with other work that they have very little time for station work. It should perhaps be remembered that thus far veterinarians have been employed by a number of institutions primarily to give instruction in veterinary medicine, and their station duties have been made distinctly a secondary matter, because of lack of funds to equip and run a department of veterinary research. As a matter of fact, however, at fully half the stations where veterinarians are employed as anything more than consulting experts they receive one-half their salary or more from station funds, and in a number of cases three-fourths. Lack of time for investigation or inability to utilize advantageously the fragments of time left from college duties is, unfortunately, not confined to the veterinarians, but is far too prevalent for the best interests of investigation.

Dr. Repp considers separately the various taxes upon the time of the station veterinarian aside from his research work. Of these the most onerous and difficult to avoid are prescribing treatment for sick or diseased animals on the basis of correspondence or otherwise, and examination of pathological and bacteriological specimens for the purpose of diagnosis. Under a strict construction such work is very properly held to be without the scope of the station veterinarian, at

least when it is of such a character or reaches such proportions as to be a hindrance to the real work of investigation. This touches a question of policy which affects nearly every department of the station. It is a difficult matter to make a general decision affecting all work of this kind, but it should be kept well within bounds, and there is perhaps reason why it should especially be restricted in the veterinary department.

The station veterinarian is not employed as a doctor, but as an investigator. He can not undertake to give up his time to public doctoring, any more than the station chemist can to being a public analyst. Both would soon be swamped with mere routine work that would more than absorb their entire time if this practice were encouraged. The station is maintained for the greatest good of the greatest number. No station veterinarian can, even if he devotes all the time and facilities of his department to that one end, doctor or prescribe for all the animals which sicken on the farmers' hands; but one farmer has just as much claim upon him for this service as another. As a matter of fact veterinary science or practice is not materially advanced by this general practice; no progress is made, as the same ground is likely to be gone over year after year, and the greatest good of the greatest number of stock owners is not subserved. Such work is not only unsatisfactory, but even risky for both the advisor and advised, for the descriptions of diseases which are sent in are often such as to make a diagnosis questionable; and furthermore, the station veterinarian, if he is a skillful investigator, may not necessarily be a good practitioner.

In States where a veterinarian is employed as a State officer, we do not find him spending his time prescribing for sick animals which are affected with ordinary ailments. He leaves that to the local veterinarians, while he attends to the larger problems of protecting the health of the live stock at large, restricting epidemics and removing the causes of contagion.

The field of activity of the station veterinarian is even more restricted than that of the State officer, and while a little advice now and then can be given without much trouble, as a rule farmers should be encouraged to employ private practitioners for their animals when occasion calls for their services. We can not agree with the position taken by Dr. Repp that the station veterinarian should render the service as a private individual and then demand a fee for it, when the requests come to him by virtue of his connection with the station. Such requests are in line with all sorts of inquiries which come to the chemist and the agriculturist and the entomologist, and the attempt to collect fees for the service rendered in such cases would be a dangerous one for a station to follow. Carried out consistently it would do far more to promote dissatisfaction than refusal to comply with the requests. But we agree with him entirely that such duties should not

be imposed upon the veterinarian to a point where, in his own judgment, they are a drag upon his more legitimate work.

Dr. Repp calls attention to the opportunities for cooperation with the veterinarians of the State, which he has found very helpful in his own case. By keeping in close touch with these men the station veterinarian is informed of the conditions about his State and can often take advantage of opportunities which arise for investigation in the field. To a certain extent these practitioners will become the medium through which the station's more technical work reaches and benefits the farmer.

Cooperation between the station veterinarians in different States where similar problems are presented is recognized as both practicable and economical. It is a recognition of the maxim that "two heads are better than one," and will often enable each to bring to satisfactory issue pieces of investigation upon which working alone little, or at best very slow, progress could be made. The more limited the time and facilities of the veterinary department the greater would appear to be the advantage of cooperation with other stations.

And, finally, effort should be made to secure from the State additional appropriation for the veterinary work where the stock interests warrant it. In doing this the stations should steer clear of being loaded down with a lot of routine work supposed to be in the interest of the advancement of the stock interests. This is a danger which has often to be met in securing State legislation for aid in a specific line. If interest is aroused it may take the form of a demand for speedy relief from a specific disease or along a particular line, which will involve the station veterinarian in much administrative or routine work which will not advance the science of treatment of disease. There are a number of instances of this kind which serve to illustrate the disadvantage rather than the aid which has followed such legislation. A small appropriation—only enough, perhaps, to pay the salary of a competent assistant—will often open the way for a more thorough line of investigation and be of more real aid in promoting such work than ten times that amount carrying with it duties of inspection, distribution of antitoxins, virus, etc. The Hatch fund should serve as a nucleus around which funds from the State for developing work in a number of different lines, as suggested by the agricultural interests of the State, should be gathered. And in this connection it should be remembered that veterinary work is of necessity quite expensive if it is to be developed so as to form one of the features of the research work of a station.

NEW BUILDING FOR THE COLLEGE OF AGRICULTURE AT THE UNIVERSITY OF ILLINOIS.

The new agricultural building of the University of Illinois, erected at an expense of $150,000, is nearing completion. It consists of a main portion 248 ft. in length, from 50 to 100 ft. in depth, and 3 stories in height, with 3 wings, each 45 by 116 ft. and 2 stories in height, connected with each other and with the main portion by corridors, all built around an open court. It is constructed of brick and terra cotta, upon a Bedford stone foundation, and roofed with slate. The entire floor space is a little over 2 acres. All partitions, except those of the

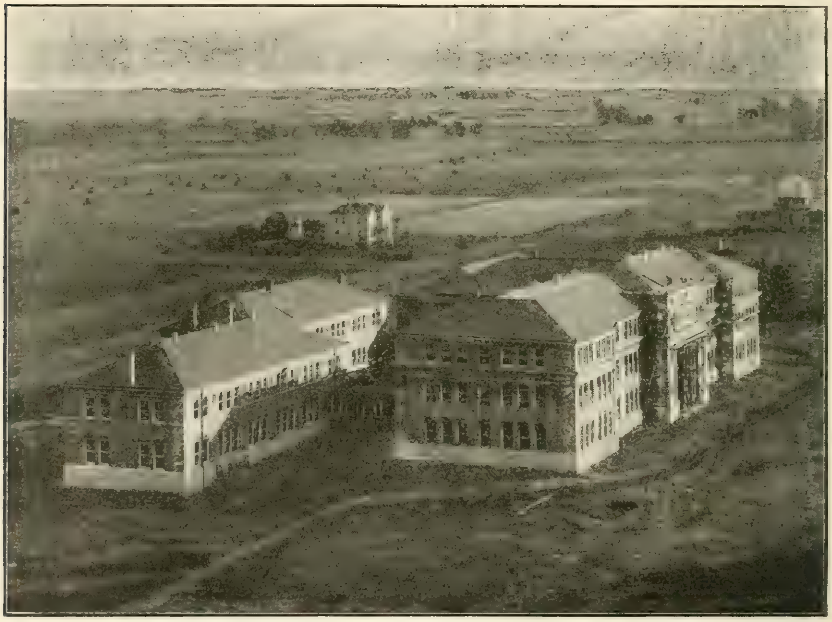


FIG. 5.—New Agricultural Building, University of Illinois.

corridors, are entirely independent of the construction of the building, so that the interior arrangement could be changed, if ever necessary, without interfering with the solidity of the construction. The inner walls are finished by painting directly upon the surface of the brick. The floors are of the so-called slow-burning mill construction, made by laying 2 by 6's face down directly upon the beams, covering these with 2 in. of cinders, and upon this laying the upper floor. The building is unusually well lighted by something over 450 windows.

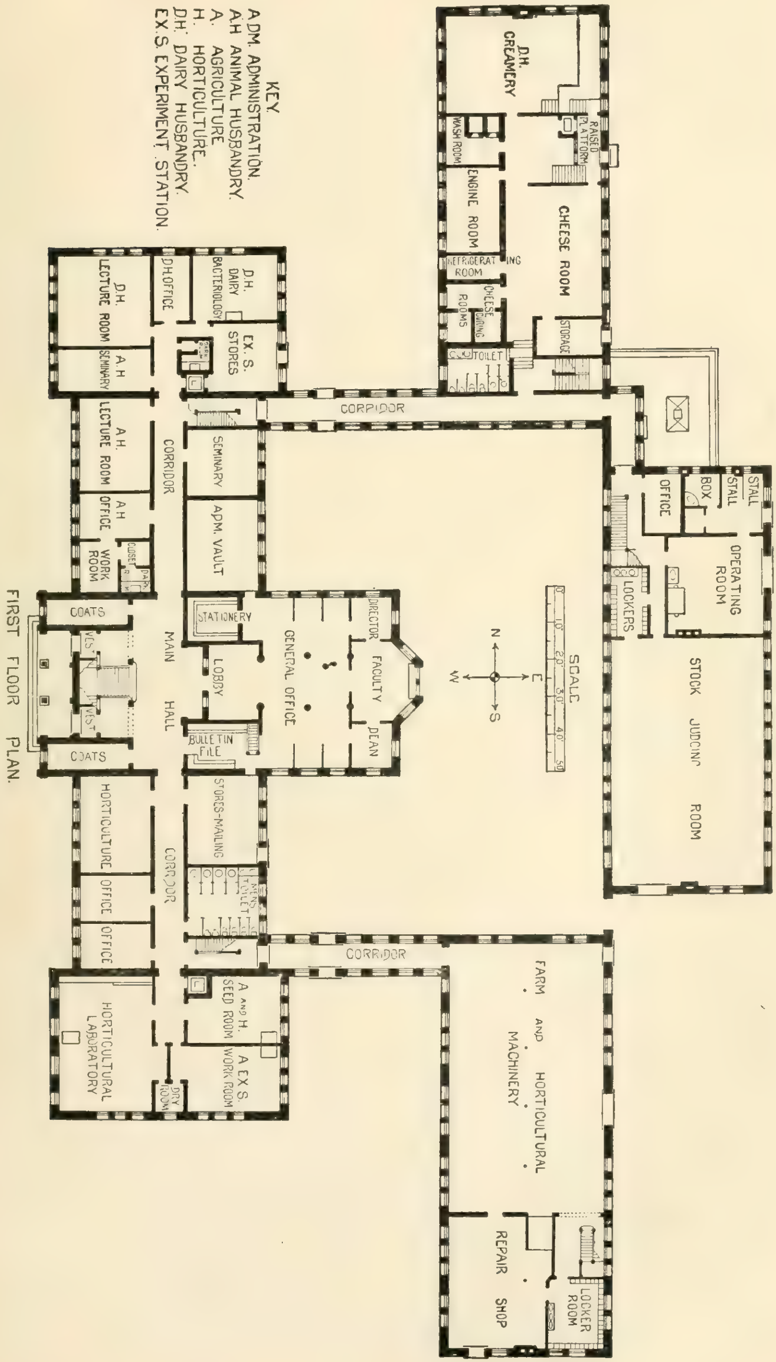


FIG. 6.—First-floor plan, Illinois Agricultural Building.

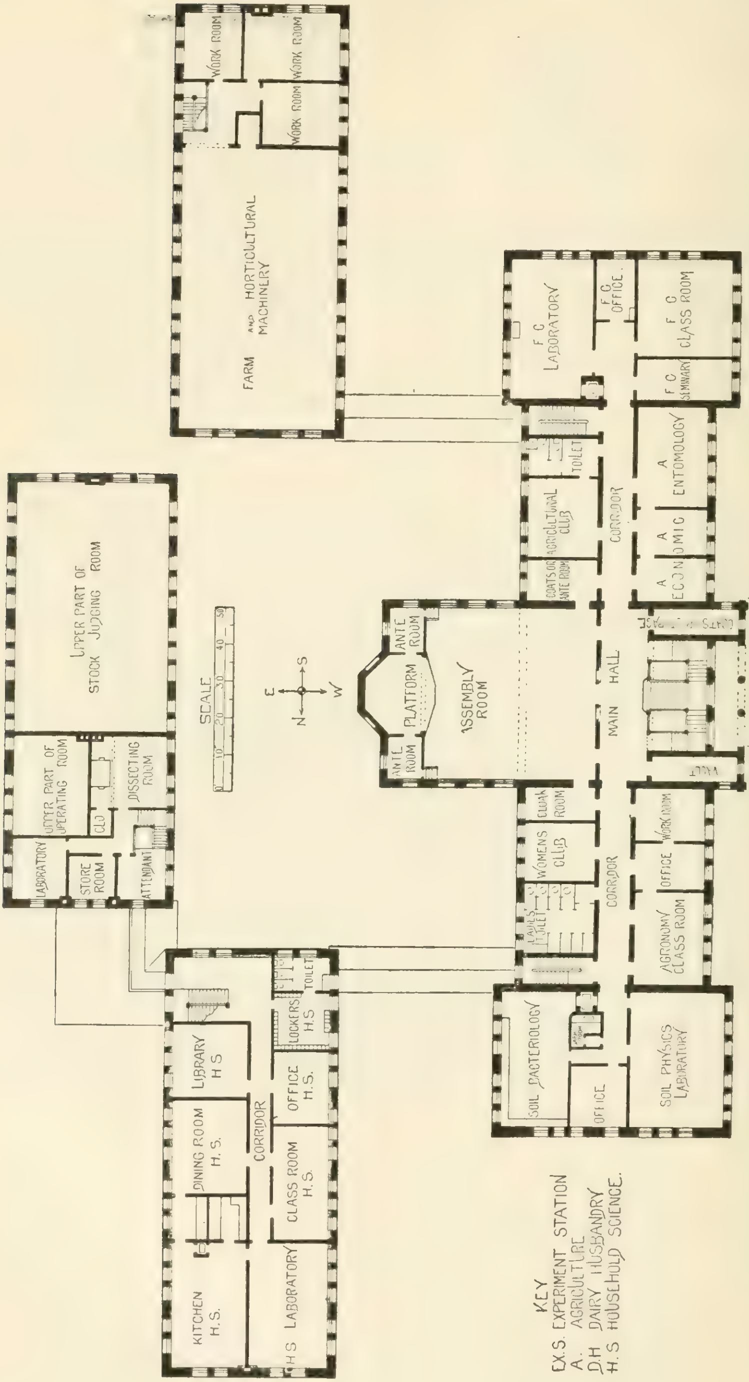
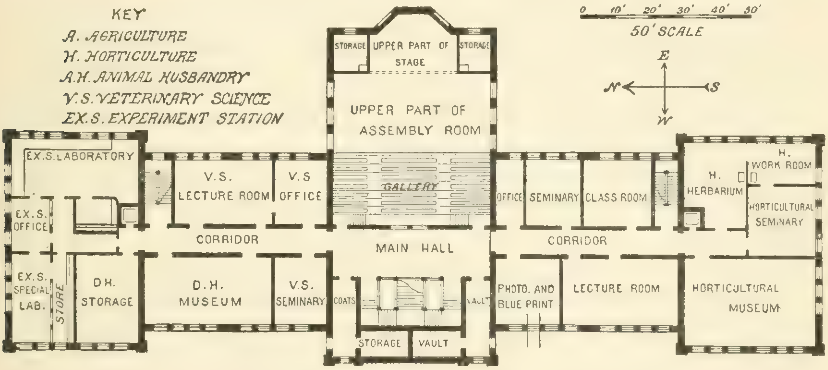


FIG. 7.—Second-floor plan, Illinois Agricultural Building.

The main building (figs. 5 and 6) contains offices, class rooms, laboratories, and seminary rooms, as well as the general offices and the assembly room. The general offices are directly opposite the main entrance of the building, on the lower floor. The entrance is into a lobby 16 ft. square opening into the main office room, 30 by 50, with excellent accommodations for 6 stenographers. Opening off this main room are a stationery room 16 by 20 ft., a fireproof vault somewhat larger, a faculty room, 2 private offices, a storage room, and a mailing room. The space underneath, about 50 by 60 ft., is cemented and will serve as a mailing room for bulletins. The south end of the lower floor is for class rooms and laboratories for horticulture and farm crops, and the north end for animal husbandry and dairy husbandry.

On the second floor of the main building (fig. 7), directly over the general offices and extending to the roof, is an assembly room capable of seating between 400 and 500 people, including gallery accommodations. Upon the south are cloak and retiring rooms for men students



THIRD FLOOR PLAN

FIG. 8.—Third-floor plan, Illinois Agricultural Building.

and upon the north similar accommodations for women students. It is designed upon occasion, when association meetings are held in the assembly room, that these small rooms may be used by visitors for similar purposes and for committee meetings. The south end of this floor affords further accommodations for work in farm crops, and also a suite of offices for the department of economic entomology. At the north end is located the main office of the department of agronomy, with class rooms adjoining; also the laboratories of soil physics and soil biology. On the third floor (fig. 8) are the experiment station laboratories, vault for the storage of negatives, blue-print room, and the office and class room for veterinary science; also museum for the department of horticulture, etc. The attic is spacious and well lighted and affords excellent storage for lighter materials.

Both floors of the south wing are given up entirely to the subject of farm machinery, and contain two laboratories, each 45 by 70 ft. These laboratories are supplied with line shafting so that any machinery can be set in motion when necessary. This wing is supplied with an office room, class room, and seminary room for students in the subject of farm mechanics.

The east wing contains the stock-judging room, 45 by 70 ft., extending the height of both stories and giving excellent light from above. It is well heated with steam, supplied with a tan-bark floor, and so arranged that animals are fastened in the middle of the room. At the north end of this wing are operating and dissecting rooms for the veterinary department, together with lockers and toilet facilities.

In the north wing the lower floor is devoted to dairy manufacturers, containing bottling and cheese rooms, creamery, wash room, sterilizers, refrigerating plant, and toilet rooms. The second floor is occupied by the department of household science.

The main building is provided with two elevators, and each of the wings with one. The building is heated by steam from the heating plant some 800 ft. away and lighted by electricity from the same source, all pipes and wires reaching the building by a tunnel and being distributed in the subbasement. The interior finish is of yellow pine, excepting in the general offices, which are of oak, and the assembly room, which is of poplar painted white.

At first some doubt was expressed as to the appearance of so large a pile of brick, but capable critics pronounce the building a decided success in every way. This opinion is based not upon any attempt at ornamentation, but upon the general effectiveness of proportions and fitness for the work it is designed to accommodate, and all agree that there is about the building an air of solid dignity that well befits the home of the college of agriculture and the experiment station.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

Phosphoric acid in the presence of saturated solutions of calcium bicarbonate, T. SCHLOESING (*Compt. Rend. Acad. Sci. Paris, 131 (1900), No. 3, pp. 149–153; Jour. Agr. Prat., 1900, II, No. 32, pp. 188–190; abs. in Bul. Soc. Chim. Paris, 24 (1900), No. 16–17, pp. 709, 710*).—This article reports experiments in which phosphoric acid solutions of known strength were added to a clear saturated solution of calcium bicarbonate, the mixture being agitated by means of a current of air free from carbon dioxid. Free carbon dioxid was gradually evolved, and quantities of the bicarbonate corresponding to the dioxid driven off were decomposed, the phosphoric acid being precipitated in the form of tricalcium phosphate. By gradually increasing the amount of phosphoric acid solution it was possible to precipitate almost the whole of the calcium present, provided the solution was allowed to stand sufficiently long (12 hours). It was shown in these experiments that tricalcium phosphate is very slightly soluble in water free from carbon dioxid. At 16 to 20° C. 1 liter of pure water dissolved 0.74 mg. of phosphoric acid. In 1,200 cc. of water, to which had been added 50 cc. of a saturated solution of carbon dioxid, 6.9 mg. of phosphoric acid was dissolved; in 1,000 cc. of water with 250 cc. of saturated solution of carbon dioxid, 48.5 mg. of phosphoric acid; and in 1,250 cc. of water saturated with carbon dioxid, 91.9 mg. phosphoric acid. It thus appears that the solubility of the phosphate increased with the proportion of carbon dioxid present in the solvent. Tricalcium phosphate is, however, practicably insoluble in carbon dioxid in a saturated solution of calcium bicarbonate. The bearing of this fact on the action of phosphatic fertilizers in the soil and on the formation of natural phosphate deposits is discussed.

A method for the rapid gravimetric estimation of lime, W. H. HESS (*Jour. Amer. Chem. Soc., 22 (1900), No. 8, pp. 477, 478*).—The method proposed is described as follows:

"The lime in the sample is precipitated and separated as the oxalate in the usual way, and the ignition is carried to the point of removing the filter from the residue of lime. The crucible is allowed to cool partially, when a portion of chemically pure dry ammonium nitrate, approximately equal in bulk to the lime in the crucible, and about twice as much chemically pure fused ammonium sulphate are added. A tight-fitting cover is now placed on the platinum crucible and then gentle heat is applied. It has been found very convenient to incline the crucible at an angle of

about 30°, allowing the tip of the crucible cover to project outward and then apply the flame to the tip of the cover, gradually bringing the flame under the crucible as the reaction grows less and less violent. The reaction is complete when fumes of ammonia salts are no longer driven off. Intense ignition is unnecessary and is to be avoided. The crucible should be weighed with its cover."

The weight unit as the basis for calculating results of physical analysis of soils, A. MITSCHERLICH (*Fühling's Landw. Ztg.*, *49* (*1900*), *No. 7, pp. 259-265*).—While the results of chemical analysis of soils are usually calculated to the weight basis, it is frequently considered desirable to calculate the results of physical analyses to the volume basis. Two methods of doing this are described: (1) One-tenth liter samples of the air-dried soil which has been put through a 1.5 mm. round-hole sieve and as uniformly compacted as possible are weighed and the moisture determined by drying over concentrated sulphuric acid. From the data thus secured the volume weight is calculated. (2) The specific volume is determined by means of a picnometer in the usual way, and the water capacity is determined by shaking up the soil (in vessels of known capacity) with water so that the air is completely displaced, the mass being allowed to stand and the excess of water finally removed. The results of these 2 determinations furnish the basis for calculating the volume weight. From the results of tests of these methods on a series of soils the following conclusions are reached: The volume unit is not a safe basis for quantitative physical investigations of the soil unless the specific volume is determined in each case. For quantitative investigations the results may be calculated from a weight to a volume basis with negligible error by assuming an average specific volume of 0.380, adding, in case of humus soils, a correction obtained by multiplying the humus content by 0.003.

Determination of tannin and of gallic acid, F. JEAN (*Rev. Chim. Analyt. et Appl.*, *5* (*1900*), *No. 4, pp. 134-140*).—The method is based upon the following principle: When iodin solution is added to a solution of tannin or gallic acid, rendered alkaline with bicarbonate of soda, the iodin forms with the astringent matter a soluble red compound, while starch is not acted upon. Briefly stated, the method is as follows: The total astringent material is first determined by titrating against the iodin solution. The tannin is next precipitated with albumin, and the remaining gallic acid titrated, a correction is made for the albumin solution, and the tannic acid determined by difference. No figures are given showing comparative results with other methods.—H. SNYDER.

Trials of some methods for cellulose determination, C. BECK (*Ztschr. Untersuch. Nahr. u. Genussmtl.*, *3* (*1900*), *No. 3, pp. 158-164*).—From tests of Lebbin's hydrogen-peroxid method (E. S. R., 8, p. 857) and König's glycerin-sulphuric-acid method (E. S. R., 10, p. 411) in comparison with the Henneberg (Weende) method, the author concludes that Lebbin's method "has neither scientific nor practical

value;" that König's method may perhaps be especially useful in examination of fodders and feces, but that for the comparison of fine-ground feed the Henneberg method is most reliable.

In a reply to the above in the same number (pp. 164–166) König shows that Beck did not follow closely the directions for his method, and points out that the greatest disadvantage of the Henneberg method is encountered with fine grain feed.

No. 6 (pp. 407–411) and No. 8 (p. 539) of the same journal contain controversial articles by Beck and Lebbin on the merits of the latter's method, in the course of which some additional precautions to be observed are pointed out, and Lebbin corrects an error in the original description of his method, 10 volume per cent of hydrogen peroxid being intended instead of 20 per cent.

Purification of phloroglucinol, G. S. FRAPS (*North Carolina Sta. Bul. 172, p. 69*).—The author prepared phloroglucinol by the following method, which gave results in the determination of furfurol closely corresponding with those obtained by the use of Merck's phloroglucinol free from diresorcinol:

"About 300 cc. hydrochloric acid 1.06 sp. gr., is heated in a beaker, 11 gm. commercial phloroglucinol added, with stirring, and the heating continued until it has almost all dissolved. Some impurities resist solution, and they may be disregarded. Pour the hot solution into sufficient of the same hydrochloric acid to make the volume 1,500 cc. Let stand at least one night (better several days), to allow the diresorcinol to crystallize out, and filter immediately before using. The solution may turn yellow, but this does not interfere with its usefulness. One hundred cubic centimeters of hydrochloric acid 1.06 sp. gr., dissolves 0.7 gm. of pure phloroglucinol."

Progress in agricultural chemistry, A. HEBEBRAND (*Chem. Ztg., 24 (1900), Nos. 91, pp. 995–998; 93, pp. 1016–1018*).—A brief review of recent investigations relating to soils, fertilizers, and plant and animal production.

The reduction of nitrates by lactic acid, L. VANINO and O. HAUSER (*Ztschr. Analyt. Chem., 39 (1900), No. 8, pp. 506, 507*).—The authors in their experiments found that the nitrates of the heavy metals were usually reduced by lactic acid, while with the chlorids and sulphates there was little or no reaction. The temperature of reduction was quite different for the different nitrates.—C. B. WILLIAMS.

An improved method for determining the total and permanent hardness of water, C. ACHILLE (*Staz. Sper. Agr. Ital., 33 (1900), No. 4, pp. 365–372*).

A new method for the determination of aluminum, E. T. ALLEN and V. H. GOTTSCHALK (*Amer. Chem. Jour., 24 (1900), No. 4, pp. 292–304*).

The influence of temperature on the specific rotation of saccharose, F. G. WIECHMANN (*Ztschr. Ver. Deut. Zuckerind., 1900, No. 537, II, pp. 902–936, fig. 1*).

The gravimetric determination of solids in milk and the differences resulting from the use of different methods, H. LÜHRIG (*Milch Ztg., 29 (1900), No. 24, pp. 371–373*). Comparative determinations by different methods are reported and the results are discussed.

Determining butter fat in oleomargarine (*Analyst, 25 (1900), Dec., pp. 309–313*).—The Public Analysts, England, adopted the Reichert-Wollny method for determining mixtures of butter fat and oleomargarine in carrying out the margarin clause of the food and drugs act. A table was adopted for estimating the percentage of butter fat in the mixture.

A comparison of the analytical and calculated results in the estimation of the dry matter in milk, G. AMBÜHL (*Chem. Ztg., 24 (1900), No. 81, pp. 871, 872*).—The dry substance was calculated by the method of Fleischmann, and compared with analytical results in 116 fresh and 1 and 2 day old samples of milk. In 96.5 per cent of the comparisons, the results differed less than 0.1 per cent. With 48 the calculated results were greater than the determined estimated, in 54 less, while in 14 the results were the same in both cases.

Detection of maize in wheaten flour, G. EMBREY (*Analyst, 25 (1900), No. 297, pp. 315–317*).—A discussion of methods.

Beeswax, J. WERDER (*Chem. Ztg., 24 (1900), No. 89, pp. 967, 968*).—Studies of methods of analysis and of waxes from various countries.

The determination of free sulphuric acid in wines, F. CARPENTIERI (*Staz. Sper. Agr. Ital., 33 (1900), No. 4, pp. 307–340*).

The adulteration of coffee with water and borax, E. BERTARELLI (*British Food Jour., 2 (1900), No. 21, p. 242*).—The author's observations were made on "Santos," one of the inferior grades of coffee sold in Italy. Upon roasting this coffee its weight decreases about 20 per cent; and some manufacturers, to make up this deficiency, soak the berries in water containing borax, the borax being added primarily to harden the coffee grains and prevent the detection of added water.

"Whenever the moisture in roasted coffee exceeds 4 per cent, adulteration may be suspected; and if borax is detected in the sample, the addition of water is certain, as this salt is always added to disguise the addition of water." In examining low-grade coffees one should always be on the alert for adulteration with water and borax.—C. B. WILLIAMS.

Investigation of the Halphen color test as to its value for the detection of cotton-seed oil, R. D. OILAR (*Amer. Chem. Jour., 24 (1900), No. 4, pp. 355–373*).

The detection of methyl alcohol in mixtures, S. P. MULLIKEN and H. SCUDDER (*Amer. Chem. Jour., 24 (1900), No. 5, pp. 444–452*).

Progress of starch manufacture, H. HANOW (*Chem. Ztg., 24 (1900), No. 82, pp. 889, 890*).—Gives statistics and late improvements in the methods of manufacture.

Errors in experiments with calorimetric bomb, LUCION (*Ztschr. Angew. Chem., 1900, No. 36, p. 910*).—The error due to the presence of traces of hydrogen in the oxygen used in determining the heat of combustion of fuel is pointed out.

The rapidity of the combustion in the calorimetric bomb, H. THIELE (*Ztschr. Angew. Chem., 1900, No. 25, pp. 607–609, figs. 2*).—The article has especial reference to determinations of the heat of combustion of fuel.

BOTANY.

Hybrid conference report (*Jour. Roy. Hort. Soc. [London], 24 (1900), pp. 348, figs. 124*).—Besides an account of the arrangements for the conference, a list of the principal plants exhibited, and accounts of the conferences at Chiswick and Westminster, July 11–12, 1899, the full text is given of the papers presented at the conference. The following is a list of the papers:

Hybrids and cross breeding as a method of scientific investigation, W. Bateson; Fertilization of the genus Anthurium, M. de la Devansaye; The hybridizing of monstrosities, H. de Vries; Hybridization and its failures, G. Henslow; Notes on some experiments in hybridizing and cross breeding, C. C. Hurst; Work of the U. S. Department of Agriculture on plant hybridization, H. J. Webber; Structure of certain new hybrids (Passiflora, Albuca, Ribes, Begonia, etc.), J. H. Wilson; Hybridization viewed from the standpoint of systematic botany, R. A. Rolfe;

Hybridization in the United States, L. H. Bailey; On self-sterility, F. Ludwig; Crossings made at the Natural History Museum of Paris from 1887 to 1897, L. Henry; Can hybrids be obtained by grafting? E. Juan; Observations on some hybrids between *Drosera filiformis* and *D. intermedia*, J. M. Macfarlane; Eucalyptus hybrids in the Mediterranean region, Trabut; On the particular influence of each parent in hybrids, L. Wittmack; Principles of hybridizing holding good in the majority of cases, M. Leichtlin; Breeding suitable food plants, W. M. Hays; On the use of transparent parchment paper boxes for artificial fertilization, H. de Vries; Hybrid Cinerarias, R. I. Linch; Creation of an important variety of *Crocus sativus*, Attempted hybridization of Dioscorea, and Notes on a hybrid of Mirabilis, P. Chappellier; A few notes on reproduction in hardy plants by means of hybridizing species and crossing varieties, C. Stuart; Fern crossing and hybridizing, C. T. Druery; Hybrid ferns, H. B. May; Hybrids between the common lilac and the laciniated Persian lilac, E. Lemoine; Hybrid clematis, A. G. Jackman; On the crossing of *Anthurium scherzerianum*, Bromeliads obtained by hybridization, and Gloxinias and their artificial fertilization, M. Duval; Notes on Hybrids, T. Meehan; Chrysanthemums, H. Weeks; On the cross fertilization of the fuchsia, J. Lye; and Notes on some hybrids, W. Smythe.

Changes resulting from etiolation, G. André (*Compt. Rend. Acad. Sci. Paris, 130 (1900), No. 18, pp. 1198–1201; abs. in Jour. Roy. Micros. Soc.* [*London*], *1900, No. 4, p. 489*).—According to the author, the etiolation of maize and lupines is not identical. In each case the total amount of carbon is reduced by about one-half, while the proportion of nitrogen remains about the same. The amount of asparagin in the lupine is much larger than that of the maize, the latter plant having apparently used up a portion of the asparagin for the production of new albuminoids. Silica in maize is 30 times more abundant in the etiolated plant than in the seed, and 15 times more than in the lupine. The relative amount of lime is the reverse in the 2 plants when etiolated. In the case of maize etiolated plants contain more potassium than the seed, while in the lupine this is not the case. The amount of phosphoric acid is said to be more abundant in etiolated plants than in others.

Some injurious effects produced by fumigation with hydrocyanic-acid gas, W. R. Beattie (*Florists' Exchange, 12 (1900), No. 29, p. 709*).—Attention is called to the fact that under certain conditions it is possible to do serious damage to plants when fumigated with hydrocyanic-acid gas. A house devoted to a general collection of plants was fumigated with one-tenth gram of 98 per cent potassium cyanid per cubic foot of space. The gas was allowed to remain in the house for 20 minutes. All the usual precautions were taken, but many of the plants began to show effects of burning after 36 hours. The damage is attributed to a number of causes. The house was new and tighter than the average greenhouse, and, being unshaded, the sun had produced a vigorous growth of the plants, which were easily injured. The effect of the gas was most noticeable on tomato plants, cardoons, grape cuttings, sweet peas, and Kenilworth ivy.

Among the plants not injured were varieties of cabbage, cauliflower, kale, celery, ferns, palms, loquats, and several species of cactus.

In general, it is stated that houses of mixed plants should not be fumigated with hydrocyanic-acid gas. A better way would be to provide a small room, conveniently located, to which the plants to be fumigated could be transferred.

Importance of bacteria to the development of plants, J. STOKLASA (*Böhm. Ztschr. Zuckerind.*, *24* (*1900*), *pp. 222–227; abs. in Jour. Roy. Micros. Soc.* [*London*], *1900, No. 4, p. 498*).—A large number of experiments were conducted by the author with *Brassica oleracea* grown in vessels containing sterilized loamy sand. In one case the sand remained sterile; in others it was inoculated with mixtures of the following soil bacteria: *Bacillus mycoides*, *B. fluorescens liquefaciens*, *B. proteus vulgaris*, *B. subtilis*, *B. butyricus*, *B. megatherium*, *B. ureæ*, *B. mesentericus vulgatus*, and *B. coli communis*. To the inoculated vessels were added 5 gm. of dextrose. In every case the total weight of the dried plant and seed were greater in the inoculated than in the sterile vessels. From this the author concludes that in the absence of micro-organisms vegetation is abnormal and that incompletely developed seed is produced.

Recent investigations on soil inoculation, J. STOKLASA (*Deut. Landw. Presse*, *27* (*1900*), *No. 7*, *pp. 389–391; abs. in Ann. Agron.*, *26* (*1900*), *No. 17*, *pp. 353–355*).—The most important point in this report is the isolation by the author of a second germ without which *Bacillus megatherium* is unable to fix atmospheric nitrogen. This new organism was isolated from humus soils, and the author attributes many of the failures with Alinit to its absence from the soil. The author recommends important changes in the method of applying Alinit. It is advised that 2 gm. of Alinit be mixed with 6 kg. of molasses and 10 liters of water. With this mixture 100 kg. of soil is moistened, the amount being sufficient for a half acre. This mixture is to be protected from strong light, sown and well harrowed into the soil some little time before seeding. By following the directions outlined, good results are claimed for Alinit when used with a number of crops.

In addition to *B. megatherium*, the ability to aid in the fixation of free nitrogen, as shown in experiments with oats, is said to be possessed by *B. fluorescens liquefaciens*, *B. proteus vulgaris*, *B. butyricus*, *B. mycoides*, and *B. mesentericus vulgatus*.

Plant kingdom, A. ENGLER (*Das Pflanzenreich. Leipsic: W. Englemann, 1900*, *pp. 45, figs. 10*).—This publication, which is the first of a series to be issued descriptive of all the known species of plants, contains descriptions of the genera and species of Musaceæ by K. Schumann. It is the plan of the editor to publish as frequently as material is prepared similar conspectuses of the different families of plants. In addition to the systematic description, notes are given on the literature, morphology, and anatomy of the plants, and also their geographic distribution.

First annual supplement to the fourth State catalogue of Ohio plants, W. A. KELLERMAN (*Bul. Ohio State Univ., 4. ser. (1900), No. 28, pp. 10*).—A list is given of plants which have hitherto not been reported in the State catalogue of the plants of Ohio. The distribution of the different species by counties is shown.

Fodder and forage plants exclusive of the grasses, J. G. SMITH (*U. S. Dept. Agr., Division of Agrostology Bul. 2, rev., pp. 86, pls. 2, figs. 46*).—This is a revised and enlarged edition (E. S. R., 8, p. 306). Many of the plants here described were either unknown or have become of increasing importance since the first edition. In the present enumeration 333 species of forage and fodder plants are described, 168 of which belong to the Leguminosæ and 30 to the Salsolaceæ.

Studies on American grasses. A revision of the North American species of Bromus occurring north of Mexico, C. L. SHEAR (*U. S. Dept. Agr., Division of Agrostology Bul. 23, pp. 66, figs. 40*).—The present paper contains descriptions of 64 species and varieties, 45 of which are native and 19 introduced. Of this number the author describes 3 species and 15 varieties as new.

Under a discussion of economic importance, *Bromus pumpellianus*, a native of the northern Rocky Mountain region is said to be very promising and, since it is closely related to *B. inermis*, is adapted to similar conditions of soil and climate. Nearly all of the introduced species are said to show decided weed propensities and are quite troublesome, especially in the Western coast region.

Enumeration of the plants producing caoutchouc and gutta-percha collected in the islands of Sumatra, Borneo, and Java, J. G. BOERLAGE (*'Slands Plantentuin, Bul. Inst. Bot. Buitenzorg, 1900, No. 5, pp. 29*).—A list, together with brief notes, is given of 76 species of caoutchouc and gutta-percha bearing plants, representing 20 genera.

Investigations on lenticels, H. DEVAUX (*Ann. Sci. Nat. Bot., 8. ser., 12 (1900), Nos. 1–4, pp. 1–240, pls. 6, figs. 7*).—A report is given on the occurrence and distribution of lenticels in plants, and special studies on their structure, origin, evolution, physiology, and function. An extensive bibliography completes the publication.

The rôle of laticiferous tissues, L. GAUCHER (*Ann. Sci. Nat. Bot., 8. ser., 12 (1900), No. 5–6, pp. 241–260, figs. 9*).

The relation between the habitat and form of Cruciferæ, E. STEIGER (*Verhandl. Naturf. Gesell., Basel, 12 (1900), No. 3, pp. 373–401*).

Sugar as an aid to the growth of plants, J. GOLDING (*Jour. Soc. Chem. Ind., 19 (1900), pp. 324, 325; abs. in Jour. Chem. Soc. [London], 78 (1900), No. 455, II, p. 617*).

Recent investigations on the diastatic functions of plants, L. BRÉAUDAT (*Ann. Hyg. et Med. Colon., 1900, No. 2, pp. 203–205*).

Notes on carbon assimilation, X. WETTERWALD (*Verhandl. Naturf. Gesell., Basel, 12 (1900), No. 2, pp. 225–243*).

The origin of tannin in galls, H. KRAEMER (*Science, n. ser., 12 (1900), No. 303, pp. 583, 584*).—Notes are given on the origin of tannin in galls produced on *Quercus coccinea* and *Q. imbricaria*. If examined in a young state, while the larvæ, which are supposed to be those of *Cynips aciculata*, are immature, a large amount of starch is observed. When the winged insects are developed, specimens treated with copper acetate solutions showed numerous brownish-red tannin masses adhering to the yellowish-brown crystals of gallic acid. The gallic acid appears to be formed at the expense of the starch in the gall, during the chrysalis stage of the insect.

A mold isolated from tan-bark liquors, KATHARINE L. GOLDEN (*Science, n. ser., 12 (1900), No. 303, p. 582*).—A note is given on a bright pink mold isolated from tan-bark liquors which were obtained from a tanning factory employing the liming process. The mold has a characteristic powdery appearance, due to the great number of spores formed. The organism fermented sucrose, dextrose, and maltose. Three distinct enzyms were developed by the action of the mold—a tryptic, a diastatic, and a rennet enzym—all of which were fairly active.

ZOOLOGY.

The crows of Germany in their relation to agriculture and forestry, Rörig (*Arb. K. Gesundheitsamte, Biol. Abt., 1 (1900), No. 3, pp. 285–400+1–151*).—During the progress of the investigations here reported the author examined the stomach contents of 5,148 crows which were killed during 1896 to 1899. Of this number, 3,259 were *Corvus corone* and *C. cornix*, while 1,523 were *C. frugilegus.* Tables are given showing the weight and percentage of the various elements of food found in each of the 3 species; and 151 pages of tabulated material is presented showing the total results of examination of stomach contents. Wheat constituted 5.7 per cent of the total food; rye, 5.5 per cent; oats, 4.7 per cent, and barley 8.2 per cent. Various fruits and garden vegetables, in a greater or less quantity, were found in the stomach contents.

Experiments showed that crows which were fed upon an exclusively vegetable diet died within a short time, and that, therefore, animal food was absolutely necessary for these birds. The animal food eaten by crows included mice, insects, fish, rabbits, pheasants, small birds, and birds' eggs. Vegetable substances constituted 70 per cent of the total food, and animal substances 30 per cent. The insects and other animals which were destroyed by the crows were for the most part injurious to agriculture or forestry, and hence the author considers the crows to be beneficial birds.

The above results are for the two first-mentioned species. In considering the seed crow it was found that plant substance constituted about one-half the food, and animal material one-fourth, while the remainder consisted of gravel and mineral substances. The animal food included mice, insects, meat, frogs, snails, and earthworms.

The author discusses various methods which have been adopted for preventing damages from these birds, including the treatment of seeds with various substances supposed to be distasteful to the crow. Experiments were made with asafœtida, quassia bark, and kerosene. These substances did not affect to any great extent the germinating power of the seeds, but did not prevent the crows from eating the seeds.

Legislation for the protection of birds other than game birds, T. S. Palmer (*U. S. Dept. Agr., Division of Biological Survey Bul. 12, pp. 94, pls. 2, figs. 8*).—The author discusses the desirability on general principles of protecting birds which can not be considered game birds, gives a brief history of the progress of protective legislation in the different States, and considers the various definitions of game birds in these State laws. A special account is given of several birds which the author believes have been erroneously considered game birds in such enactments. These birds include pigeons, doves,

flickers, bobolinks, meadow larks, blackbirds, and robins. The definition of various classes of birds other than game birds which are protected is in most cases loose and ambiguous. A brief digest is presented of the legislation of various States upon the subject of plume birds. Attention is called to the widespread prejudice against birds of prey, and it is suggested that at least a number of hawks should be protected on account of their known feeding habits. A table is given showing the species of birds protected in each State and in the Canadian Provinces. A digest is also presented of the regulations regarding the permits for collecting birds and eggs for scientific purposes in different States. The author discusses the Hoar Bill, the Teller Bill, and the Lacey Act.

Appended to the bulletin is a compilation of the State laws for the protection of birds and the laws of the Canadian Provinces on the same subject.

Protection and importation of birds under act of Congress approved May 25, 1900, James Wilson (*U. S. Dept. Agr., Division of Biological Survey Circ. 29, pp. 6*).—This circular contains a copy of the Lacey Act for the protection of birds and a commentary by the Secretary of Agriculture, explaining the powers and limitations of the Department of Agriculture in this matter and the methods which must be adopted by importers or shippers of animals included in the act.

Directory of State officials and organizations concerned with the protection of birds and game, T. S. Palmer (*U. S. Dept. Agr., Division of Biological Survey Circ. 28, pp. 8*).—This list is printed also in the Yearbook for 1899 (pp. 710–717).

Distribution of the seed crow in Germany, Rörig (*Arb. K. Gesundheitsamte, Biol. Abt., 1 (1900), No. 3, pp. 271–284, pls. 2*).—The author made a detailed study of the distribution of *Corvus frugilegus* in the various provinces of Germany. Notes are given on the present position of large colonies of these birds, their nesting habits, and upon the means which have been adopted for destroying the birds. Bounties are offered in a number of localities for seed crows.

Revision of the pocket mice of the genus Perognathus, W. H. Osgood (*U. S. Dept. Agr., Division of Biological Survey, North American Fauna No. 18, pp. 63, pls. 4, figs. 15*).—This bulletin contains an account of the literature relating to the genus under discussion, and a discussion of the distribution, color and pelages, habits, classification, and new species of this genus. An analytical key is presented for the determination of species and subspecies, all of which are described.

The destruction of mice by means of oats treated with strychnin and sugar, A. Schneebeli (*Ann. Agr. Suisse, 1 (1900), No. 7, pp. 269–275*).—On account of the mildness of two successive winters the fields in the canton of Zürich were badly overrun with mice, and great damage to crops resulted. The usual methods for the destruction of these animals proved insufficient during these successive invasions. Recourse was had to inoculation with the bacillus of mouse typhus and to poisoning by means of oats treated with sugar and strychnin. Satisfactory results were obtained by the latter method, and it was observed that dogs and cats which ate the poisoned mice were not affected.

Oligochæta, W. Michaelsen (*Das Tierreich. Berlin: R. Friedländer & Son, 1900, No. 10, pp. XXIX + 574, figs. 13*).—A general systematic account of the earthworms, with extensive bibliographical references.

Arsenical soap and its supposed preservative action upon the skins of museum specimens, L. Vieira (*Ann. Sci. Nat., 6 (1900), pp. 29–32*).—From a quite

extensive experience with mounted specimens of birds and animals in museums the author concludes that the use of arsenical soaps upon such specimens has no influence in preventing the attacks of museum pests upon the specimens. *Anthrenus varius* was found to deposit its eggs and multiply as rapidly in skins which had been treated with this soap as in those which had received no treatment.

METEOROLOGY.

Report of the director of the New York Weather Bureau, 1898, E. A. FUERTES (*Rpt. New York State Dept. Agr., 6 (1898), II, pp. 1-473, charts 28*).—This report includes daily and monthly summaries of observations on temperature at some 96 stations in 51 counties of the State, on precipitation at 120 stations, and on atmospheric pressure at 8 stations, a review of the crop conditions during the year, and descriptions and brief historical accounts of some of the stations of the bureau.

The average temperature for the State during 1898 was 48.1° F.; the highest was 103°, at Primrose and West Point, July 3; the lowest, —40°, at Elizabethtown, February 3. The average pressure was 30.03 in.; the highest, 30.71 in., at Albany, March 26; lowest, 28.97 in., at Number Four, February 15. The average precipitation was 43.56 in.; the greatest, 69.2 in., at Brentwood; the lowest, 28.8 in., at Ogdensburg. The average snow fall was 62.4 in., ranging from 143 in. at Number Four to 40 to 65 in. in the interior of the State, and 30 to 40 in. on the coast. The number of days on which precipitation amounted to 0.01 in. was 137. The average cloudiness was 54 per cent.

The principal features of the season from October, 1897, to September, 1898, are shown in the following table:

Monthly temperature and precipitation and departures of each from the normal.

Year and month.	Mean temperature.	Departure.	Average precipitation.	Departure.
1897:	°F.	°F.	Inches.	Inches.
October	51.0	+2.8	1.06	−2.45
November	37.6	+0.6	4.81	+1.51
December	28.2	+1.0	3.83	+0.94
1898:				
January	23.5	+1.6	4.32	+0.89
February	26.3	+2.8	2.96	+0.05
March	40.0	+9.8	2.22	−0.51
April	42.8	−1.0	2.92	+0.25
May	56.3	+0.2	4.33	+0.86
June	66.8	+1.0	3.06	−0.72
July	72.2	+2.4	3.12	−1.03
August	70.0	+2.5	6.00	+2.34
September	63.8	+3.2	2.96	−0.41

"The average temperature for the year was unusually high, a deficiency obtaining for the month of April only . . . . The crop season on the whole was fairly successful."

Meteorology, W. FREAR and C. W. NORRIS (*Pennsylvania Sta. Rpt. 1899, pp. 257-277, 284-343*).—"The work of the past 2 years has been chiefly a continuation of the preceding years [E. S. R., 9, p. 815], including observations of the kind usually made by the United

States Weather Bureau upon atmospheric phenomena and upon the amount of sunshine." Monthly summaries of observations are given in the body of the report and the detailed record in an appendix. The summaries for 1897 and 1898 are as follows:

Summary of meteorological observations, 1897 and 1898.

	1897.		1898.	
	Whole year.	Growing season (Apr.–Sept.).	Whole year.	Growing season (Apr.–Sept.).
Barometer (inches):				
Mean	30.050		30.035	
Highest	30.720 (Jan. 31)		30.533 (Mar. 26)	
Lowest	29.340 (Mar. 24)		29.482 (Feb. 15)	
Temperature (°F.):				
Mean	48.9	61.8	49.9	63.6.
Highest	92 (July 10, Sept. 16).	92	95 (July 3)	95 (July 3).
Lowest	−5 (Jan. 26)	24	0 (Jan. 30, Feb. 2, 4).	17 (Apr. 5).
Greatest daily range	40 (Sept. 16)	40	39 (Dec. 31)	35 (May 9).
Mean daily relative humidity (per cent).	82	77.6	81.3	78.
Rainfall (inches):				
Total	43.44	23.62	34.35	18.68.
Greatest monthly	5.69 (July)		6.51 (Oct.)	
Greatest daily	1.32 (Nov. 1)	1.30	2.11 (Oct. 21)	1.21 (Aug. 4).
Number of days on which 0.01 in. or more of rain fell.	138	74	137	65.
Mean percentage of cloudiness	56.10	47.8	56	50.50.
Number of days on which cloudiness averaged 80 per cent or more.	111	36	118	49.
Average hours of sunshine per day		6 h. 4 m.		
Wind (miles):				
Total movement	18,990		18,735	
Maximum velocity per hour	34 (Dec. 24)		40 (Dec. 5)	
Greatest daily movement	390 (Apr. 27)		580	
Last frost in spring		May 8		May 9.
First frost in fall		Sept. 18		Oct. 3.

The principal periods of crop development in the seasons of 1897 and 1898 are stated.

Meteorological observations, J. E. OSTRANDER, A. C. MONAHAN, and C. L. RICE (*Massachusetts Hatch Sta. Met. Buls. 139, 140, 141, pp. 4 each*).—Daily and monthly summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during July, August, and September, 1900, with notes on the general characteristics of the weather of those months.

Meteorology, P. BONÂME (*Rap. An. Sta. Agron.* [*Mauritius*], *1898–99, pp. 1–15*).—Observations on temperature, pressure, humidity, and rainfall during 1898 and 1899 are reported. The distribution of the rainfall and other features of the seasons of the two years are discussed.

Meteorological influences on the growth of beets in 1899, L. KUNTZE (*Ztschr. Ver. Deut. Zuckerind, 1900, No. 529, II, pp. 153–158*).—The influence of the season on the growth of sugar beets is briefly discussed.

An electric frost alarm, L. BURING (*Queensland Agr. Jour., 7* (*1900*), *No. 4, pp. 346, 347, figs. 2*).—This is a description, quoted from *Garden and Field*, of an apparatus constructed by J. Richard, of Paris. The essential feature of the alarm is a metal tube, similar in construction to the one used in a Bourdon pressure gage, filled with amyl alcohol. The motion caused by the expansion or contraction of this tube with the change in temperature is communicated by means of a metal rod to a clock-like apparatus which operates a pointer on a thermometric scale. This apparatus can be set so that at a given temperature an electric current which rings a bell will be started.

WATER—SOILS.

On the movement of water and salt solutions in soils, S. Kravkov (*Jour. Landw., 48 (1900), No. 3, pp. 209–222*).—The movement of water was studied with diluvial sand (subsoil) in glass tubes 3 meters long and 3.6 cm. in diameter. The downward movement of water was the most rapid, the lateral movement next, and upward capillary movement slowest. The rapidity and height of capillary rise was almost in inverse ratio to the moisture content of the soil, *i. e.*, the drier the soil the more rapid and the higher the rise. The greater the depth of water maintained over the surface of the soil the more rapid the percolation.

In the experiments with salt solutions, tenth-normal, fifth-normal, and normal solutions of potassium and sodium phosphates (K_2HPO_4, Na_2HPO_4), potassium and ammonium sulphates, sodium nitrate, chlorid, and carbonate were used in glass tubes 50 cm. long and 2 cm. in diameter filled to a height of 45 cm. with soil (421 gm.). The solutions were maintained at a depth of 0.5 cm. over the surface of the soil and the rate of percolation noted. It was found in the experiments with diluvial sand that the salts which are more readily absorbed by soils percolated more rapidly than those which are not absorbed, although the differences were very small. In experiments with loamy sand it was found that the addition of any of the salts lessened the capillary rise of water, the nonabsorbable salts being more active in this respect than the absorbable. Those salts which tended to loosen the soil had the least retarding effect on the movement of water in the soil.

Experiments on the effect of various salts applied in solid form gave generally inconclusive results. It was observed, however, that gypsum and calcium carbonate hastened the capillary rise of water.

Muck experiments, J. D. Towar (*Michigan Sta. Bul. 181, pp. 157–164, figs. 5*).—This is an account of experiments during 1898 and 1899 on tenth and twentieth acre plats of swamp or muck land on the station farm to test the effect of different methods of fertilizing, as follows: Applications of leached ashes, 5 tons per acre in 1898; unleached wood ashes, 1 ton per acre; sand, 1 in. thick over the surface in 1898; air-slaked lime, 2 tons per acre in 1898; commercial fertilizer, containing 2.53 per cent of ammonia, 11.24 per cent of available and 0.26 per cent of insoluble phosphoric acid, and 1.61 per cent of potash, 400 lbs. per acre in 1898, 200 lbs. per acre in 1899; a home-mixed fertilizer, having approximately the same composition as the commercial fertilizer, 355.2 lbs. per acre in 1898, 170.6 lbs. per acre in 1899; stable manure, 20 loads per acre in 1898; nitrate of soda, 400 lbs. per acre in 1899; dissolved phosphate rock, 800 lbs. per acre in 1899, and muriate of potash, 400 lbs. per acre in 1899. Three plats received no

fertilizer, and one of these was thoroughly rolled. The nitrate of soda, dissolved phosphate rock, and muriate of potash were used singly and combined by twos.

A variety of field and garden crops were grown. No definite results were obtained the first year, although in every case the fertilizers increased the yield, the barnyard manure giving the best results. The yields on the different plats are tabulated.

"(1) In general, the result of the muck experiments indicate a uniformity in the requirements of the various crops and that stable manure meets those requirements in fuller measure than anything else. It appears that the legumes tried—garden peas and soy beans—are the only exceptions to this rule. . . .

"(2) Air-slaked lime, which in the past has been highly recommended as a treatment for muck land, acted on this even slightly acid muck in opposition to our expectations, for where it was applied at the rate of 2 tons per acre the yield was generally less than where nothing was applied. The yield apparently increased as the quantity applied was enlarged.

"(3) Sand has given contradictory results, though frequently its yield is higher than the adjacent 'nothing' plat. These results are in no measure the entire benefit to be derived from this one application, but it is still a problem whether it will pay to apply sand to a muck field at the rate of 140 loads per acre.

"(4) Leached ashes gave results similar to those from sand, and though yet inconclusive, we believe that where this material may be had for a few cents per wagonload and is within 4 or 5 miles it may be applied with profit.

"(5) So far the complete fertilizers do not give results that will warrant their purchase in considerable quantities for muck land.

"(6) Unleached wood ashes gave very satisfactory results, as did also the mixture of phosphate rock and potash salts, indicating the lack of mineral manures and an abundance of nitrogenous manures in this soil."[1]

The reclamation of salt land in Egypt, G. BONAPARTE (*Jour. Khediv. Agr. Soc. and School Agr., 2 (1900), No. 4, pp. 170–175, fig. 1*).—The origin and composition of alkali, or *sabach*, as it occurs in Egypt, the injuries which it causes to plants, plants which are resistant to alkali, and methods of reclaiming alkali lands (*ard sabach*) are briefly treated. An effective method of removing the excess of salts practiced in Egypt is as follows: Open drains 70 cm. to 1 meter deep are placed at intervals of 50 meters one way and 150 the other, in the latter case alternating with the irrigation laterals. The main canals are 1,000 meters apart. The water is maintained at a depth of 10 cm. over the soil for 6 months. Rice, barnyard grass (*Panicum crus-galli*), and a sedge (*Cyperus lævigatus*), used in making mats, are then usually planted.

The needs and treatment of the Warwick Plain and other sandy soils of Rhode Island, H. J. WHEELER and G. E. ADAMS (*Rhode Island Sta. Bul. 68, pp. 159–174*).—The district known as the Warwick Plain is "essentially embraced within a line extending from Apponaug to Pontiac, then along the Pawtuxet River to its outlet,

[1] The results obtained with sugar beets in these experiments have been reported in an earlier bulletin (E. S. R., 12, p. 540).

and thence around the shore to Apponaug." The soils of this district are with few exceptions comparatively level and naturally poor and sandy. They are also frequently acid. An analysis of a sample of the soil collected near Greenwood is reported, which indicates that there is "a great need of most, if not all, of the kinds of plant food which are liable to be lacking in soils." Plat experiments with fertilizers on table beets and muskmelons at 2 places in the Warwick Plain and pot experiments at the station with barley on soil from one of these localities are reported, with a discussion of the needs of the soils and the best means of their improvement. While the soils are deficient in all of the principal elements of plant food, potash is apparently less needed than either phosphoric acid or nitrogen. "Lime is probably needed as plant food, and particularly to overcome the acidity of the soil." Small applications of lime which has been exposed to the air for a long time are recommended, as well as the stocking of the soil with humus by the growing of leguminous plants for green manure.

Examination of water for household and industrial uses, H. Boursault (*Recherche des eaux potables et industrielles. Paris, 1900, pp. 200, figs. 16*).

Miscellaneous water analyses (*Oklahoma Sta. Rpt. 1900, pp. 73-75*).—A brief statement of analyses of 18 samples examined mainly with regard to their mineral constituents.

Lower Michigan mineral waters, A. C. Lane (*Water Supply and Irrigation Papers, U. S. Geol. Survey, No. 31, pp. 97, pl. 1, maps 3, figs. 2*).—"A study into the connection between the chemical composition of these mineral waters and their mode of occurrence."

Underground temperatures during a hot wave in South Australia (*Science, n. ser., 12 (1900), No. 309, p. 851*).—Refers to "an interesting case of slow penetration into the ground of the high temperatures of a hot wave" described in a report by Sir Charles Todd on "Rainfall in South Australia and the Northern Territory during 1897."

Analyses of soils, C. F. Juritz (*Rpt. Senior Analyst, Cape Good Hope, 1899, pp. 41-71, map 1, dgms. 3*).—This is an account of the work on the systematic soil survey of the Cape of Good Hope to the end of 1899. This work has been reported on from time to time and noted in the Record (E. S. R., 12, p. 122).

Soil investigations of the Tokay wine regions, B. von Bittó (*Landw. Vers. Stat., 54 (1900), No. 5-6, pp. 337-348*).—This is a brief record (mostly in tabular form) of examinations, mainly with reference to content of calcium carbonate of the soils of this region, undertaken with a view to determining their adaptability to the American grape.

The rational analysis of clays from the agricultural point of view, E. Van den Broeck (*Bul. Soc. Belge Géol., 14 (1900), No. 3, pp. 161-166*).—This is a discussion of the results of analyses of samples of Tertiary clay from the vicinity of Brabant by the hydrofluoric acid method proposed by A. Proost, which, it is claimed, affords a truer index of the fertilizing constituents of the soil available for the use of plants than the ordinary method using hydrochloric acid.

Investigations on the potash in cultivated soils, C. Dusserre (*Ann. Agr. Suisse, 1 (1900), No. 2, pp. 66, 67*).—Attention is called to the greater efficiency of the hydrofluoric acid method than of the hydrochloric acid method in determining the reserve potash of the soil, and tests of the relative action of different fertilizers

in rendering the potash and lime of the soil soluble are reported. The most effective agents in rendering soil potash soluble in distilled water were gypsum and sulphate of ammonia. The substances which were most active in rendering the lime soluble were potassium chlorid and ammonium sulphate.

The effect of sand and lime on heavy marsh soils, KLAUSEN (*Landw. Wchnbl. Schleswig-Holstein, 50 (1900), No. 46, pp. 794–798, figs. 2*).—Beans, fall wheat, clover, barley, and oats were grown in pots of (1) heavy marsh soil alone; (2) heavy marsh soil mixed with 15 per cent of sand which contained 3.58 per cent of calcium carbonate found underlying the marsh soil; (3) mixed with 15 per cent of sand free from lime; (4) mixed with marl containing 3.58 per cent of calcium carbonate; (5) mixed with quicklime equivalent to the amount of calcium in (2); and (6) mixed with noncalcareous sand and calcium carbonate equivalent to the amount of carbonate in (2).

Detailed and summarized results are given. They are believed by the author to show that the value of the calcareous sand is due primarily to the lime which it contains. Its modification of the physical character of the soil is of secondary importance. The sand which contained no lime was valueless and in some instances its use resulted in decreased yields. The leguminous plants were more responsive on the limed or marled soils than the cereals. In general it is concluded that the effect of the calcareous sand in ameliorating heavy marsh soils can be secured much more cheaply by the use of marl at the rate of about 6.7 tons per acre.

Cooperative soil test experiments, J. D. TOWAR (*Michigan Sta. Bul. 181, pp. 147–157*).—Cooperative experiments with fertilizers on corn, potatoes, field beans, and sugar beets at 13 different places in Michigan are reported. The soils experimented with are described and the fertilizers applied and the yields obtained in the different experiments are tabulated. While the results in many cases are inconclusive, in a few instances they furnish the basis for some deductions as to the fertilizer requirements of the soils tested.

Examination of mineral specimens (*Oklahoma Sta. Rpt. 1900, pp. 68–72*).—Examinations of 141 samples are briefly reported.

FERTILIZERS.

On the composition of the gas confined in barnyard manure, P. P. DEHÉRAIN and C. DUPONT (*Ann. Agron., 26 (1900), No. 6, pp. 273–294*).—Observations made on 2 comparatively large heaps of manure are reported. The observations included determinations of the temperature and humidity of the heaps at stated intervals and chemical examination of samples of gas collected from the top, center, and bottom of the heaps during August and September, 1899. In the chemical examination of the gas, determinations of carbon dioxid, oxygen, methane (CH_4) and hydrogen, and other observations were made. The results show that there was generally sufficient carbon dioxid present in the heaps to prevent the dissociation of ammonium carbonate except in the upper portion of uncovered heaps after a heavy rainfall. Aerobic fermentation was always in progress in the upper part of the heaps and extended to the lower layers when the manure was not closely packed. Wetting the heaps reduced this fermentation. Fermentation resulting in the formation of free hydrogen was observed only in cases of closely packed manure and was

often accompanied by the abundant evolution of carbon dioxid. It occurred only in neutral or slightly acid manure and ceased when the manure was moistened with the liquid which drained from the heaps. Since this fermentation is sometimes accompanied by loss of nitrogen in the free state it should be prevented by keeping the manure heaps moistened with liquid manure. Fermentation resulting in the evolution of methane was found to occur in well-packed manure. In such cases the gas resulting from fermentation is composed solely of methane and carbon dioxid and no nitrogen is lost in the free state under such conditions. The abundant evolution of carbon dioxid which accompanies the marsh gas fermentation also prevents dissociation of ammonium carbonate. This desirable fermentation is promoted by keeping the heaps of manure wet with the liquid portion.

Investigations on the action of the phosphoric acid and nitrogen in Leipsic poudrette and in von Krottnaurer's Blankenburg fertilizer, O. BÖTTCHER (*Deut. Landw. Presse, 27 (1900), No. 77, pp. 953, 954*).—The first of these fertilizers is prepared by drying fecal matter with sulphuric acid; the second by treating slaughterhouse refuse, etc., in the same manner. Analyses of samples of the two products and pot experiments to test their fertilizing value are reported. The samples of poudrette examined contained from 4.3 to 5.38 per cent of phosphoric acid, 1.96 to 2.9 per cent being soluble in citrate solution, and 0.42 to 0.69 per cent soluble in water; 4.19 to 5.54 per cent of nitrogen, 2.16 to 2.4 being in form of ammonia; and 3.78 to 5.1 per cent potash. In the 2 samples of the other fertilizer examined the phosphoric acid varied from 6.4 to 8.3 per cent, 0.1 to 0.35 per cent being soluble in citrate solution and 4.4 to 6.2 per cent soluble in water; 5.49 to 6.34 per cent of nitrogen, 0.31 to 0.39 per cent being in the form of ammonia and 0.15 to 0.21 being in form of nitrate. These fertilizers were compared with double superphosphate and nitrate of soda on oats grown in a moderately compact loam soil. As regards the action of the phosphoric acid the 2 fertilizers were but slightly less effective than the double superphosphate, while as regards nitrogen they were scarcely half as effective as nitrate.

The occurrence and composition of lime in Maryland, together with the results of experiments in testing its use in agriculture, H. J. PATTERSON (*Maryland Sta. Bul. 66, pp. 91–130, maps 2*).—This bulletin includes a general discussion of the relation of lime to agriculture; the action of lime on soils; the time and methods of applying lime; methods of determining the need of lime; descriptions of different kinds of lime used in agriculture; the occurrence and composition of lime in Maryland, including analyses of 121 samples of limestone, 2 of oyster shells, 27 of burned lime (stone and oyster shell) 5 of gas lime, and 90 of marl; and accounts of experiments with lime made at the station since 1889.

In 1889, 1890, and 1891, gypsum 370 lbs. per acre, quicklime 2,000 lbs. per acre, and shell marl 8,000 lbs. per acre, were compared on corn and wheat on a well-drained sandy loam soil, "The results show that the sulphate of lime and the quicklime produced marked effects the first year of application, but that the carbonate showed no effect until the second year. In the sum total of the 3 years' crops all of the applications proved to be quite beneficial, and the quicklime produced the greatest increase in yields."

In another series of experiments with corn and wheat carried out during 1890 and 1891, stone lime 2,000 lbs. per acre, oyster-shell lime 2,000 lbs. per acre, ground oyster shells 2,000 lbs. per acre, marl 4,000 lbs. per acre, and gypsum 233 lbs. per acre, were compared on stiff clay naturally inclined to be wet. In all cases the yields were increased by the application, the ground oyster shells being especially effective, and much more so than the marl.

An account is given of a series of experiments begun in 1893 and partly reported in a previous bulletin (E. S. R., 10, p. 633), to test the effect of lime (20 bu. per acre) on a rotation of corn, wheat, and hay. The results up to the close of 1899 are reported. The figures show "that the application of lime to this land was a beneficial and profitable procedure." In a series of experiments begun in 1896 on stiff clay land, inclined to be a little wet, varying amounts of lime (10 to 60 bu. per acre) were compared on the above rotation. The experiments have been partly reported (E. S. R., 10, p. 633). The results for 4 years (1896–1899), show "that small applications of lime have proven to be as efficient at the end of 4 years as the larger applications, and that the relative profits, up to date, are in favor of applying 20 bu. per acre. It is of interest to note that in the hay crop the 10 bu. of lime gave the largest net return."

Since 1896 experiments have been in progress to test the effect of lime in connection with green manure. Stone lime was applied at the rate of 40 bu. per acre, cowpeas were sown, which were turned under for wheat, the wheat was followed by clover, which was cut for hay, and the land planted to corn. The net gain from the wheat, hay, and corn was $4.97 in case of cowpeas alone and $5.03 in case of cowpeas and lime. The combination of cowpeas and lime seemed to have a more lasting effect than cowpeas alone.

During 5 years (1895–1899) experiments have been made to test stone lime at the rate of 1,400 lbs. per acre, oyster-shell lime 1,400 lbs., magnesium oxid 1,400 lbs., barium oxid 1,400 lbs., shell marl 13,000 lbs., finely ground oyster shells 2,600 lbs., gypsum 4,125 lbs., gas lime 2,925 lbs., finely ground South Carolina rock 2,925 lbs., and soft-coal ashes 13,000 lbs. per acre. Corn was grown during 4 years, wheat one (1897).

The reported results show that—

"(1) The best yields were obtained with the lime in the form of a carbonate, the finely ground oyster shells standing first and the shell marl standing second. This was further substantiated when the stone lime was applied as a top-dressing and given an opportunity to form carbonate of lime by absorption of carbonic acid from the atmosphere.

"(2) Pure magnesium lime, which is commonly claimed to be poisonous to the soil and crop, gave the highest yield.

"(3) Barium oxid, which is not a plant food, produced very nearly as much increase in the yields as the calcium oxid, and more increase than the sulphate or phosphate of lime. This would seem to indicate that there was some effect produced on the soil rather than that the plants needed lime as a plant food.

"(4) The lime applied so as to slake in the soil produced a slightly better total yield than when first slaked and harrowed in.

"(5) Stone lime and shell lime were of about the same value on the soil.

"(6) Lime with fertilizer was more profitable than fertilizer alone.

"(7) All the applications of lime increased the yields."

Experiments in denitrification, T. B. WOOD (*Bd. Agr. [London], Rpt. Agr. Education and Research, 1899–1900, pp. 124, 125*).—Experiments on oats with nitrate of soda alone and combined with fresh (long) and well-rotted (short) manure on a heavy and rather wet clay soil in 1898 and on a lighter humus soil resting on bowlder clay in 1899 are briefly reported. The manure was used at rates of 10 and 20 tons per acre. The average yields were greater with nitrate alone than with nitrate and manure, the difference being especially marked in case of the long manure. With nitrate alone there was an increase of grain of 9½ bu. per acre in 1899; with nitrate and long manure there was practically no increase.

Analyses of commercial fertilizers, C. A. GOESSMANN (*Massachusetts Hatch Sta. Bul. 68, pp. 28*).—This bulletin reports analyses of 275 samples of fertilizing materials, including wood ashes, limekiln ashes, leather-scrap ashes, cotton-hull ashes, silicate, muriate, and sulphate of potash, kainit, nitrate of soda, sulphate of ammonia, bone, tankage, apatite, South Carolina rock phosphate, odorless phosphate, castor pomace, stable refuse, cotton waste, and mixed fertilizers.

Analyses of commercial fertilizers, J. HAMILTON and W. FREAR (*Pennsylvania Dept. Agr. Rpt. 1899, pt. 1, pp. 821–974*).—This includes the text of the Pennsylvania fertilizer law, notes on valuation of fertilizers, tabulated analyses and valuations of fertilizers examined during 1899, and a list of fertilizer manufacturers securing licenses for the sale of fertilizers in Pennsylvania in 1899.

Commercial fertilizers, H. J. WHEELER, B. L. HARTWELL, ET AL. (*Rhode Island Sta. Bul. 67, pp. 151–156*).—Analyses and valuations, accompanied by guarantees, of 14 samples of fertilizers are reported, with a schedule of prices used in the valuation of fertilizers and brief notes on the conduct of the fertilizer inspection.

Analyses of commercial fertilizers (*South Carolina Sta. Bul. 54, pp. 13*).—This bulletin includes a table of prices of unmixed fertilizing materials and tabulated analyses and valuations of 154 samples of fertilizers examined during the season of 1899–1900.

Analyses of fertilizing materials, P. BONÂME (*Rap. An. Sta. Agron. [Mauritius], 1898–99, pp. 18–20*).—Analyses of ashes of bagasse and dry cane leaves, calcareous sea sand, and lime used for agricultural purposes are reported.

The rational use of chemical fertilizers, P. LIECHTI (*Ann. Agr. Suisse, 1 (1900), No. 7, pp. 243-268, figs. 4*).—The extent of the use of fertilizers in the Canton of Berne is discussed and an account is given of pot experiments by the Wagner method with oats to test the relative efficiency of different fertilizers on soils of different character. Analyses of the various soils experimented with and the details of the experiments are given in full, with a discussion of the practical application of the results.

The use of lime upon Pennsylvania soils, W. FREAR (*Pennsylvania Dept. Agr. Bul. 61, pp. 170, figs. 2, map 1*).—This is a detailed discussion, based upon investigations at the Pennsylvania Station and elsewhere, of the agricultural uses of lime; the limestones of Pennsylvania; the burning, slaking, and quality of different kinds of lime; the functions of lime in plants and soils; the influence of liming upon soils and the relative value of magnesian limestones; and methods of liming. An appendix gives analyses of Pennsylvania limestones compiled from various sources.

Field experiments with night soil near Posen (*Mitt. Deut. Landw. Gesell., 15 (1900), No. 37, pp. 225-228*).

FIELD CROPS.

Subexperiment farms, W. M. HAYS ET AL. (*Minnesota Sta. Bul. 68, pp. 557-730, figs. 38, dgms. 24*).—Results are here recorded of experiments conducted at the 3 subexperiment farms in the State, preceded in each instance by general notes on the purpose of the farm and its method of management by W. M. Liggett.

Experiments at Coteau farm (pp. 563-651).—This farm is located in southwest Minnesota, where droughts are frequent and often severe. The work of the farm has therefore been mainly directed toward ameliorating their effects by different systems of tillage, manuring and cropping, the use of shelter belts, etc.

In a study of the amount of soil moisture best suited to the growth of flax in upland soil containing 13.02 per cent of organic matter and in lowland soil containing 28.6 per cent, the best result in the case of the upland soil was obtained when 30 per cent of water was used. With lowland soil 100 per cent of water gave the strongest flax. These results are believed to show that the larger the amount of organic matter in the soil the greater the endurance of plants to extremes of drought and rainfall.

The results obtained in farm tillage experiments are reported in crop yields and soil moisture content and shown by tables and a comprehensive system of charts. The moisture content of the upper 2 ft. of a soil which had been in wheat and yielded about 2 tons of grain and straw per acre averaged about 15 per cent less than a cultivated soil which had borne no crop. Using 80 lbs. as the average weight of the soil, it is estimated that for each pound of dry matter produced in this case some 261 lbs. of water was required.

The losses of moisture in a field of corn occasioned by the growth of 3,540 lbs. of weeds per acre was very marked, especially at depths of from 3 to 6 in., and the corn crop was reduced from 12,762 lbs.,

where thorough cultivation was given, to 6,989 lbs., or more than 50 per cent, where the weeds (mostly pigeon grass) were allowed to grow freely. It is believed that the weeds evaporated more moisture per pound of dry matter than the corn. This point is being further studied.

Compacting the lower portion of the furrow slices with a subsurface packer has had little or no effect in increasing the moisture in the lower portion of the slices, either when the ground was fall or spring plowed or when coarse manures were plowed under. Subsoiling for corn has apparently reduced the yield of grain 19 per cent and of stover 15 per cent. With wheat the grain yield was slightly reduced and the weight of straw slightly increased on the subsurface-packed plats. Out of 17 comparisons with oats, potatoes, turnips, fodder, corn, wheat, and sugar beets, 14 show a decreased yield from subsoiling. The conclusion reached is that "subsoiling is expensive and not profitable under most conditions in Minnesota."

With wheat the average results for 3 years show equal yields from spring and fall plowing. Practical experience, however, suggests early fall plowing as being more desirable, from the standpoint of economical farm management and weed destruction. A fall-plowed seed bed absorbed more moisture and resulted in an increased yield of 2.6 bu. of grain over an unplowed stubble land. The unplowed stubble seed bed did not conserve moisture as well as the plowed land and more weeds grew on it. Harrowing growing wheat when it is a few inches high has resulted in an average decreased yield for 2 years of 0.6 bu. per acre. In experiments in broadcasting *v.* drilling wheat, drilled wheat has averaged 9.5 bu. per acre for 2 years and broadcasted 6.25 bu. The drilled wheat was more deeply and strongly rooted and was less injured by frost. Seeding wheat at the rate of about ½ bu. per acre in drills 14 and 21 in. apart and cultivating between the rows has not given as good yields as the usual method of seeding 1¼ bu. per acre in drills 7 in. apart without cultivation. Manuring increased the yield of grain and slightly reduced the ratio of grain to straw. It seemed to decrease the moisture content of the plowed ground the first year, while increasing it the second.

The moisture content of soils surface cultivated, mulched, plowed, and plowed and subsoiled was studied. "At the depth of 3 to 6 in. the surface-cultivated soil had only about 1 per cent more moisture during most of the season than the soil which was compact to its surface, and late in the season it had no more." When the soil was plowed 6 in. deep and subsoiled 7 in. deeper, the moisture in the subsoil was much better conserved by the loosened earth than in bare compact soil. Plats mulched with a layer of straw 4 in. deep contained 5 per cent more moisture than bare soil, fluctuated with weather changes less sharply, and retained their warmth longer.

The author briefly summarizes the results of the tillage experiments for the conservation of moisture as follows:

"Soil moisture is conserved by plowing, which loosens the soil to the depth of several inches; by cultivating between the rows, which keeps loose the upper 2 in. of soil; by mulching, which allows the rain to penetrate the soil but not leave it; and by having the plowed furrow slice cleanly fallow all or part of the year, thus avoiding the draft of growing plants on the soil moisture. It is dissipated by growing crops which pump into the air enormous amounts of water; by weeds which are perniciously active pumps in proportion to the useless growth they make, and by leaving the soil compact, allowing capillary water to rise to the surface, there to evaporate."

Among the meadow and pasture crops grown, *Bromus inermis* is the only new grass whose merits have been proven. The yields obtained from 30 mixtures of pasture plants are tabulated, and several mixtures especially adapted to different soils and for different purposes are recommended.

The number of days of pasture furnished by several annual pasture crops for steers and sheep are also shown. The practice of growing succulent forage crops for feeding off during the dry midsummer and early spring and late fall is commended.

The value of the shelter belts of willow hedge at the farm as an aid in growing crops and establishing deciduous trees is considered and a diagram given of the arrangement of the Coteau farm hedges. A four-year-old willow hedge already stands 15 ft. high.

Northwest experiment farm (pp. 652–687).—The northwest experiment farm is located in the rich lowlands of the Red River Valley on ground typical of that region. Results secured in variety tests with a number of grains, grasses, clovers, and forage crops are recorded, as are also data obtained in seeding grasses and clovers with different nurse crops.

Minnesota No. 163 and Wellman Fife have given the best average yields with wheat; Minnesota No. 190, Early Gothland, and Black Russian, in the order named, with oats, and Golden Queen, Odessa, and French Chevalier with barley. *Bromus inermis* has proven one of the most promising of the grasses tested. With this grass and with mammoth clover, and mixtures of timothy and clover, best results have been obtained when seeded without a nurse crop. Red clover has given the best results when drilled in with barley.

Northeast subexperiment farm (pp. 688–730).—This farm is located in the pine region of northern Minnesota, and is made up of a number of different soil types, namely, poor sandy loam, on which jack or Norway pines grow, light-colored clays, swampy soil of the type called "Muskeg," and various mixtures. The general work and equipment of the farm is noted, and some results obtained in field tests with grains, forage crops, potatoes, vegetables, and orchard and small fruits are recorded. Thus far Blue Stem wheats have yielded from 2 to 3 bu.

more per acre than Fife varieties and have been less affected by rust. The Improved Ligowa oat stands at the head of 23 varieties tested. Six-rowed types have given the best yields of barley, and of these Mansbury is much the best. White Canada field peas have yielded the best of the peas grown. With forage plants red and alsike clovers have done better on light soils than the true grasses. *Bromus inermis* has given the best results of the grasses tested on light soil. American Wonder has given the highest average yield of the potatoes grown for 3 years—260.4 bu. per acre. The farm is considered as being very nearly the most northerly point at which apples can be grown. The varieties thus found hardy are Silken Leaf and Christmas; crab apples, Martha and Virginia.

Report of agricultural investigations in Alaska in 1899, C. C. Georgeson (*U. S. Dept. Agr., Office of Experiment Stations Bul. 82, pp. 55, pls. 17*).—This bulletin deals more especially with the establishment of agricultural experiment stations at Sitka and Kenai, and the growing of cereals, forage plants, flax, and vegetables at these stations and at Kadiak.

Experiments in making and storing silage and in making hay from native grasses have been successfully carried out during the year. New lands have been cleared, and the value of lime in correcting the acidity of fresh soil demonstrated. The Alaskan soil is fertile, and when properly drained and treated is productive. All of the common hardy vegetables, such as potatoes, cabbage, cauliflower, kale, peas, onions, carrots, parsnips, parsley, lettuce, celery, radishes, turnips, beets, and the like, of excellent quality, have been grown successfully, and many garden flowers do well. Tomatoes, beans, cucumbers, melons, and sweet corn are not successful. Red, mammoth, alsike, and white clovers grow luxuriantly. They have withstood the winters, and the earlier blooms matured seed. Vetches, lupines, rape, field peas, and timothy have likewise grown vigorously, and yielded a large amount of forage. Wheat, barley, oats, flax, rye, and buckwheat have all matured. Some of the serious drawbacks to grain growing in Alaska are the heavy growth of straw induced by the moist climate and the difficulty of harvesting on account of the abundant fall rains which set in early in September and even in August. Flax grows especially well, producing straw from 2½ to 3 ft. high and of good fiber. Flaxseed has regularly matured.

Notes on the growth of each of a number of varieties of all the above noted crops are recorded in the report and many details given regarding the clearing of land, drainage and improvement of peat lands, Alaska as a stock country, value of silos in Alaska, difficulties in the way of securing homesteads, etc. Letters are reported from a number to whom seeds were distributed giving the results obtained.

Meteorological data showing the temperature and weather conditions in 1899 at a number of different localities are appended.

Notes on clover, J. D. TOWAR (*Michigan Sta. Bul. 181, pp. 164, 165*).—The great difficulty in securing a good catch of clover when seeded with wheat, as was formerly the practice in Michigan, led to experiments in seeding this crop alone on well prepared ground. Two eighth-acre plats 4 rods apart were used in the test. On 1 plat clover was seeded with wheat; on the other the ground was well prepared and the clover seeded alone. Both plats were seeded the same day. The clover seeded with the wheat was an entire failure, though the wheat yielded at the rate of 42 bu. per acre, while on the plat seeded to clover alone a good stand was secured, and a yield of 4,067 lbs. of hay was obtained as a first crop.

Experiments were begun in 1899 to determine the most desirable time to seed clover in Michigan. From results secured up to the present time from April to June seems to be the most satisfactory time for seeding.

Corn experiments, L. FOSTER and L. A. MERRILL (*Utah Sta. Bul. 66, pp. 101–117, figs. 4*).—Different varieties of corn were compared and tests made of the relative value of deep and shallow tillage, of hilling and level tillage, and of thick and thin planting. Earlier results secured along these lines at the station have been noted (E. S. R., 6, p. 527). While corn does not produce as much forage per acre in Utah as alfalfa, it is considered a valuable adjunct to the latter and a desirable crop to grow in rotations, taking the place of an occasional summer fallow in freeing the land from weeds. The climatic conditions for growing corn are not especially favorable in Utah, the seasons being rather too short and the general temperature too low, especially the night temperature. It has been demonstrated, however, that "all of the best flint varieties, the small dents, and the semidents will fully mature in the locality of the experiment station." The dent varieties, however, after being a few years under cultivation tend to take on the appearance of the flints. From 3 to 5 irrigations were given in the different years.

The yield of 17 varieties, including flint, dent, and semident corns, during periods of 5 to 10 years, are tabulated by years and averaged. A white flint corn, the variety usually grown in the Cache Valley, has given the largest yields in 7 out of 10 years, and the highest average by 6.8 bu. of all the varieties tested for 10 years—46.22 bu. per acre. Next in order of productiveness are Angel of Midnight, North Dakota, and Golden Beauty, all flint varieties. The average number of days from planting to cutting corn in Utah has varied with the varieties tested from 116 days in the case of White Flint to 151 days with Long Yellow Flint.

In the deep and shallow tillage experiment, corn was given shallow, medium, deep, and no tillage, and was scarified and mulched with sowed dirt. The test covered 5 years and the results are tabulated for each year. On the whole medium tillage has given slightly the

best results. Two seasons out of 5 the plat not tilled gave better yields than any of the tilled plats, while 4 years out of 5 the plat receiving sowed dirt gave better yields than the plat receiving no tillage.

The experiments in hilling *v.* level culture cover a period of 7 years. Some plats were given level culture or hilled one way while others were given level culture or hilled both ways. The average results are in favor of level culture both ways. For 8 years corn has been planted in hills at the rates of 3, 6, and 9 kernels per hill, respectively. The yield of corn fodder obtained each year is tabulated. The result in favor of planting 6 kernels to the hill was so decisive in the average of the 8 years that the authors feel justified in drawing the conclusion that seeding under or over this amount will not give as good results. Results secured at other stations in tests of hill *v.* drill culture of corn are discussed. In general they "show but very little difference between hill and drill planting."

Corn silage, sugar beets, and mangels—a comparison of their yield and cost of production, H. J. WATERS and E. H. HESS (*Pennsylvania Sta. Rpt. 1899, pp. 104–111*).—Further data on the cost of growing and yield of dry and digestible matter per acre of corn, sugar beets, and mangels are given (E. S. R., 6, p. 446). Three varieties of corn and one each of sugar beets and mangels were grown on an upland clay soil of moderate fertility, uniformly prepared and fertilized. A portion of the corn was grown on unfertilized land and the results included in the general averages with corn. The corn was grown in rows 42 in. apart with the kernels 14 in. distant in the row. When harvested it was hauled to the barn, cut into ¾ in. lengths, and ensiled. "The beets were planted in rows 34 in. apart and thinned to one plant every 7 to 10 in. in the row. They were cultivated with a horse hoe 6 times and hand-weeded twice. All vacancies were filled by transplanting." The yield of green and dry matter for each crop is tabulated, and the relative cost of production compared.

The yield of air-dry substance of the mangels averaged 4,554 lbs. per acre, sugar beets 4,683 lbs. per acre, and corn 6,763 lbs. per acre. It is thus seen that the corn yielded about 46.6 per cent more dry matter than the roots. Taking the averages obtained with the corn per acre as a unit, it is calculated that it would require 1.49 acres of mangels or 1.44 acres of sugar beets to produce as much dry matter as one acre of corn.

The cost of the labor and material required to grow, harvest, and store the beets was at the rate of $57.54 per acre, while the cost of growing and ensiling corn was $16.17 per acre. "In other words, 4,615 lbs. of air-dry substance in roots cost $57.56 as compared with 6,763 lbs. of corn at a cost of $16.17." Or, reduced to a uniform basis, it cost 5.17 times as much to produce 100 lbs. of air-dry substance in the roots as in the corn.

A résumé is given of the cost of growing sugar beets at other stations which shows a variation of from $33.85 to $60.50 per acre, with an estimate of $35 per acre as the lowest average cost under the most favorable conditions; while the cost of growing corn in Illinois has been reported as $10.59 per acre (E. S. R., 10, p. 540).

Experiments with barley, roots, and grass lands in 1899, H. C. SHERINGHAM ET AL. (*Ann. Rpt. Field Expts. Irish Agr. Organization Soc., 1 (1899), pp. 5–43, figs. 6*).—Barley was grown in 4 of the more important barley counties of Ireland and fertilized with different commercial fertilizers. Roots were grown in 3 counties, barnyard manure and commercial fertilizers being used, while in 2 others fertilizer experiments were made for the improvement of permanent grass lands. The results secured in the barley experiments show the necessity of early seeding (February or early March). The drills should be 8 in. apart rather than 4½ in. Chevalier barley is advocated for seed. But little advantage was found in sweating barley for seed purposes. It is recommended that phosphatic manures always be applied with nitrate of soda. After a straw crop nitrogenous manures in moderation should be added to superphosphate and potash manures for barley in order to secure a full crop. Nitrogenous manures should never be applied alone.

With the root crops it is shown that heavy dressings of barnyard manure for turnips are not necessary, and that even better crops can be obtained by replacing a portion of the manure with superphosphate. On heavy soils barnyard manure proved of little use, but on porous soils it gave good results, particularly when applied with about 300 to 400 lbs. of superphosphate per acre. The experiments also show that turnips can be successfully produced with commercial fertilizers alone. Phosphoric acid is the ingredient they most require and is best supplied in superphosphate. Kainit on light soils appeared to be a profitable manure when used with superphosphate, but on heavy soils it was injurious. If barnyard manure is not used, nitrogen in the form of nitrate of soda should be applied.

The results on the old pasture lands showed in part that a nitrogenous manure was of but little benefit, while kainit had an injurious effect. Phosphatic manures used alone gave excellent results, while the best results were obtained from a judicious mixture of both nitrogenous and phosphatic manures. Sulphate of ammonia and Peruvian guano are considered the best forms of these manures.

The effect of manures on the percentage composition of the herbage was also studied. The tabulated results show "that the nitrogenous manures produce an injurious effect upon the herbage, reducing the percentage of clover and increasing the percentage of rough, coarse grasses and weeds. On the other hand phosphates and potash, when applied together, and particularly when lime was added to the mix-

ture, largely increased the percentage of clover, reduced the percentage of weeds, and greatly improved the general quality of the hay."

Some hay, forage, and pasture plants for Arkansas, R. L. BENNETT (*Arkansas Sta. Bul. 61, pp. 17*).—The most desirable and satisfactory hay plant for summer growing in Arkansas, considered from the standpoint of food produced and fertilizer added to the soil, is the cowpea, the Whippoorwill and Wonderful varieties being preferred. Detailed directions for growing, handling, and stacking the crop are given, including descriptions of a stack frame for curing hay in unfavorable weather.

As a crop for winter growing for hay, soil protection, and soil improvement, hairy vetch (*Vicia villosa*) has proved most satisfactory, followed in order by crimson clover and red clover. The value of each of these crops in different portions of the State is considered in detail and cultural directions given. Corn and sorghum are considered the best forage crops for the State. Sorghum is preferred for summer feeding for hogs and dairy cows. Cutting may be begun as soon as the stalks begin to head out. Hogs like it best when the stalk is sweet and the grain in the milk stage. In order to preserve the sorghum in this state it is recommended to pile the stalks in large piles and cover with straw. Early amber is the variety usually grown.

The results of 7 years' tests at the station indicate that the grasses best adapted to the soils and climate of the State are orchard grass, Bermuda grass, and hairy vetch for permanent meadows, and Bermuda grass and hairy vetch for permanent pastures. The characteristics of these grasses and the method of cultivation and combining to suit the soils in the different parts of the State are discussed. The prejudice against Bermuda grass held by many farmers, because of its weed-like tendencies, is considered unfounded, since by proper methods of rotation and cultivation the grass is easily controlled. Alfalfa is considered a valuable plant for permanent meadows and pastures where both surface and subsoil are well drained. Considerable care is required in getting it started, but after being once started it is permanent.

A list of the more valuable clovers and other legumes, forage plants, and grasses that have been tested at the station for 10 years is appended. Spanish peanuts and chufas are considered superior to other plants for hogs. Peanuts are considered the better of the two since they yield better and add more fertility to the soil.

Effect of liming upon the relative yields and durability of grass and weeds, H. J. WHEELER and J. A. TILLINGHAST (*Rhode Island Sta. Bul. 66, pp. 137–146, figs. 11, dgm. 1*).—All the plats used in these experiments have received like amounts of potash and phosphoric acid since 1890. Certain plats have received in addition each year when manure was applied $\frac{1}{3}$, $\frac{2}{3}$, and full rations of nitrate of soda, sulphate of ammonia, and dried blood, respectively; full rations in

each instance representing equal amounts of nitrogen. A definite portion of the southern end of each plat, except the control plat, was limed in 1893 at the rate of 2½ tons of air-slaked lime per acre. The north end of 3 plats received in addition lime at the rate of 5 tons per acre in 1891, and in 1892 an additional amount equivalent to 3.3 tons per acre. Indian corn, oats, clover, and barley were grown on the plats up to the fall of 1897, when they were seeded down with a mixture of 15 lbs. each of meadow-oat grass, awnless brome grass (*Bromus inermis*), Kentucky blue grass, and orchard grass. The Kentucky blue grass failed to germinate. The yield of green material obtained on the limed and unlimed sections of the different plats for each of the years 1897 and 1898 are tabulated. The herbage on definite areas of the limed and unlimed portions of each plat was sorted, weighed, and photographed.

In 1897 the average yield of green material on the limed portions of the plats was at the rate of 6.72 tons per acre, and on the unlimed portions 3.86 tons per acre, a gain of about 74 per cent by liming. In 1898 the average yields on the limed and unlimed sections were at the rate of 5.02 and 1.96 tons per acre, respectively, a gain of 156.1 per cent by liming. Considerable variation in yield occurred on the differently fertilized plats. The largest yield of green material in both years was obtained on the limed plats fertilized with a full ration of nitrate of soda (480 lbs. per acre), followed by full rations of sulphate of ammonia and dried blood. Considerable green material in each instance was grown on the unlimed portions of these plats. In the case of the nitrate of soda plat, this consisted mostly of grass, while with sulphate of ammonia, sorrel was the chief constituent. The especially good showing as regards yields of grass of the unlimed section of the nitrate of soda plats is thought to be due to the gradual neutralization of the soil acidity by years of continuous application of this fertilizer.

As regards the growth of weeds on the different plats, the percentages on the limed section in 1897 ranged from 8.1 to 28.9, though in only one case did it exceed 18.3. On the unlimed sections the percentages ranged from 3.5 to 99.1, and in 3 instances it equaled or exceeded 81.8. The bulk of the weeds on the unlimed section was made up of sorrel.

The weights and percentages of each species of herbage found on the different plats in 1898 is shown in tabular form. With orchard grass and awnless brome grass marked increase in yield regularly resulted from liming. Meadow oat grass was helped some by liming, but was less dependent on its presence than either orchard grass or awnless brome grass. Timothy was not sown on the plats, but appeared in nearly every instance on the limed sections and but twice on the unlimed sections, indicating the value of neutral or slightly

alkaline soil for this plant. Redtop appeared in but 4 instances, 3 of which were upon unlimed soil. This is in accord with previous observations at the station to the effect that redtop can succeed on a soil too acid for the successful growth of either blue grass or timothy. Clover was found upon every one of the limed plats, but was wholly absent on the unlimed sections, and the best clover was found upon the plats which had received potash and phosphoric acid but no nitrogen.

Potato experiments in 1899, G. MARTINET (*Ann. Agr. Suisse, 1 (1900), No. 2, pp. 45–49, dgm. 1*).—A record is given of the results obtained in tests of a large number of varieties of potatoes in 12 different localities and of the effect on yield of growing potatoes at different altitudes.

As a result of the tests of varieties, Silesia and Cygnea are recommended for the general crop.

In order to determine the effect of altitude on the yield of potatoes, 2 varieties grown at an elevation of 580 meters were planted at an elevation of 780 meters in comparison with the same varieties regularly grown there. Conversely, tubers grown at the higher altitude were planted at the lower altitude in comparison with the same varieties of native-grown tubers. The results show that the total yields of both varieties were higher by from 5 to 10 per cent at the higher altitude than at the lower, and that the seed tubers from the higher altitudes gave the better yields under all circumstances.

Notes on sand lucern, J. D. TOWAR (*Michigan Sta. Bul. 181, pp. 165, 166*).—Sand lucern was sown on 2 tenth-acre plats on light drifting sand at the station at the rate of 15 lbs. per acre. The lucern was given entire possession of the ground. No crop was produced until the second year, when it was mowed 3 times, yielding at the rate of 6,800 lbs. per acre on one plat and 5,917 lbs. on the other. The plant withstood the severe winter of 1898–99, when fruit trees, wheat, clover, and other hardy plants were killed, and the following season produced 4 crops, amounting to 10,580 lbs. on the better plat. The first cutting was obtained May 31.

Sand lucern is a legume, closely resembling alfalfa. It is recommended for light sandy soils where the moisture is a considerable distance below the surface. Samples of seed have been distributed to the farmers throughout the State for experimental planting.

Sugar-beet and sorghum investigations in 1899, A. D. SELBY (*Ohio Sta. Bul. 115, pp. 175–193*).—*Sugar beets* (pp. 175–188).—The cooperative cultural experiments with sugar beets reported in 1897 and 1898 (E. S. R., 11, p. 142) were continued in 1899. Five hundred lbs. of seed, made up of 4 varieties, was received from this Department and distributed by the station to the farmers throughout the State. An uneven stand was obtained by many farmers. Germination tests

seemed to show that the trouble was not due to poor quality of seed. In order to prevent this loss, earlier planting—in March or early April—is advised. The results obtained in the different sections of the State are tabulated in detail for each grower, summarized, and compared with the results of previous years. The data secured from the northern section of the State were especially satisfactory. The sugar content of 355 samples averaged 13 per cent and the purity 81.5 per cent. For the whole State the averages were 12.7 and 80.2 per cent, respectively.

The striped blister beetle was especially injurious to the sugar beet in many sections of the State during the season.

Sorghum (pp. 189–193).—Five varieties of sorghum seed obtained from this Department were distributed to 122 growers in 54 counties of the State, especially to the central and southern sections. The varieties distributed were chiefly Colman, Folger Early, and Early Amber, with Collier, Oomseana, and Denton in small quantities. The reports are not very definite as to Denton and Collier. Oomseana is highly spoken of, particularly for forage purposes, and some report favorably as to its sirup-making quality. This is a slender, leafy variety, apparently adapted to forage uses. Early Amber has commonly succeeded best for sirup making, because maturing earlier in this State than the Colman, which generally made a larger growth than the other sorts. The Colman receives commendation from some for sirup making and universally as forage for green feeding. Folger Early is reported as standing up better than Colman and ripening ealier than Oomseana.

One of the main objects of the experiment was the distribution of seed to be used by the farmers in the production of seed for future crops. In most instances this result was secured. The detailed report on the growth of sorghum is recorded in letters from 6 farmers, and analyses are given with reference to the sugars found in the sorghum juices and of the composition of 3 samples of sorghum sirups.

The culture and handling of tobacco in Maryland, J. H. PATTERSON (*Maryland Sta. Bul. 67, pp. 131–152, figs. 8*).—Among the topics treated are the methods of selecting, grading, packing, and topping Maryland tobacco; varieties for Maryland and methods of improving them; uses of green manure for supplying humus and improving the yield and quality of tobacco; fertilizers for tobacco; root system of the tobacco plant; methods of tillage; and the relation of original and natural vegetation to the adaptability of soils for tobacco culture.

Trials in growing cigar tobacco at the station have shown that with imported Cuban seed, planted on good soil, a large tobacco of fair quality can be produced. The expense of growing, however, more than counterbalanced the increased price received for the tobacco. The bulk of the crop grown in Maryland is smoking tobacco.

Old tobacco lands at the station which were deficient in organic matter and produced crops with a large proportion of ground leaves were brought into good condition by the use of green manures, supplemented with commercial fertilizers. Crimson clover was the crop used for turning under. It is seeded immediately after the tobacco crop is taken off in the fall, usually the last of August or first week in September, and turned under the following spring in May. By this method of culture the quality of the tobacco has been greatly improved, and within 3 years the yield increased more than threefold. When crimson clover will not do well, cowpeas are advocated. The lack of organic matter in the soil is considered one of the chief causes of the deterioration in quality of the tobacco grown in some sections of the State and the consequent low prices.

In experiments with commercial fertilizers for tobacco, the use of lime and magnesia in large quantities tended to cause a growth that ripened unevenly and was hard to cure, though the combustibility was slightly improved. "On the whole, the application of lime immediately before planting tobacco can not be recommended. Phosphoric acid seemed to have but little bearing upon the combustibility, but generally produced a marked increase in the yield." Potash salts seemed to be the most potent factors in affecting the composition. The use of forms containing considerable amounts of chlorin resulted in tobacco of poor quality and combustibility, while the use of the sulphate and carbonate forms has improved the quality and increased the yield. The following fertilizers are considered as being adapted for use in growing tobacco in Maryland: Dissolved South Carolina rock, dissolved bone, dried fish, bone tankage, cotton-seed meal, nitrate of soda, sulphate of ammonia, high-grade sulphate of potash, carbonate of potash and magnesia, and cotton-hull ashes. These should be used with green manures. The fertilizer used at the station with good results consisted of 1,300 lbs. of dissolved South Carolina rock, 400 lbs. of tankage, 100 lbs. of nitrate of soda, and 200 lbs. of high-grade sulphate of potash. Sulphate of ammonia and nitrate of soda are considered particularly valuable for use in the plant bed for growing strong early plants.

The relationship existing between the vegetation and good tobacco lands, and also the harmful effect on quality of growing certain crops on tobacco lands, is illustrated by a table showing the relative rates at which chlorin and potash are removed from the soil by certain plants common in tobacco sections.

The pine lands (commonly a species of red pine) are considered to be the best tobacco lands in Maryland, and chestnut lands stand next, while "oak and hickory lands are commonly regarded as poor tobacco soil." In the former case the ratio between chlorin and potash removed is comparatively narrow, while in the latter it is very wide.

The much larger amounts of chlorin removed by the pine and chestnut trees suggests a reason for the improved quality of the tobacco grown on such lands. Frequently old fields are allowed to lie idle for a time with the idea of reclaiming them for tobacco. Broom sedge (*Andropogon virginicus*) is one of the most common plants on these fields, and later "old field pines" usually come in. The large relative amounts of chlorin taken up by these plants explains the improvement of such lands for tobacco.

The root system of tobacco at different stages of growth is shown in a number of figures. Frequent and shallow cultivation of tobacco is recommended.

Wheat experiments, J. D. TOWAR (*Michigan Sta. Bul. 181, pp. 166–169*).—These consist of variety and cultural tests and experiments in top-dressing *v.* plowing under manure. In the variety tests 12 different sorts were used. The 3 best sorts in the order of their productiveness were Gold Coin, Dawson Golden Chaff, and International No. 6, all yielding between 31 and 32 bu. per acre.

The cultural experiments with wheat involved 5 different methods of preparing the seed bed. The ground was oat stubble. Plat 1 was gang-plowed 4 in. deep and followed by 2 harrowings and the grain drill; yield, 23.74 bu. per acre. Plat 2 was plowed 8 in. deep, immediately after removing the oat crop, followed promptly by the roller and the harrow, and harrowed thereafter at intervals of about 10 days until the wheat was sown; yield, 23.65 bu. per acre. Plat 3 was allowed to lie until the day before the wheat was sown. It was then plowed, rolled, and harrowed twice with a spring-tooth harrow and once with the Acme; yield, 19 bu. per acre. Plat 4 was harrowed twice with a spring-tooth harrow immediately after the removal of the oat crop. Two weeks later the operation was repeated. It was plowed the day before the wheat was sown as in plat 3, but only one harrowing was found necessary; yield, 22.93 bu. per acre. Plat 5 was treated the same as plat 3, but had been spring plowed for oats instead of fall plowed, as was the case with plat 3. Yield 16.3 bu. per acre. The largest yield was, therefore, from shallow plowing (plat 1), but the author is not convinced that this method of preparation is the best. As a result of this experiment it is concluded that "whatever operations may be performed to conserve the moisture immediately after removing the oat crop will result in an increased yield of the succeeding wheat crop."

The results obtained in top-dressing and plowing under manure were practically identical.

Winter wheat, J. ATKINSON (*Iowa Sta. Bul. 51, pp. 24–30*).—The acreage of winter wheat is being gradually extended in Iowa. The yield obtained from winter wheats has been about double that obtained from spring wheats, the average for 10 years with winter wheats being 45.1 bu. per acre.

Nineteen varieties of winter wheat, chosen because of their supposed hardiness, were grown in 1899–1900. Five of the varieties winter-killed and 10 others partially, while the remaining 4 passed through the winter without the slightest injury. These 4, in the order of productiveness, were Turkish Red, Bearded Fife, Buda Pesth, and Bulgarian. The yields varied from 55.2 in the case of the first to 51.3 with the last. Turkish Red is recommended as the variety best suited to the conditions of the State.

In a test of bald *v.* bearded wheat, the average yield in 1899–1900 for 6 bearded varieties was 47.5 bu. per acre, while for 8 bald varieties the average yield was 17.3 bu.

The milling qualities of the 2 classes of winter wheat, hard and soft, were investigated, samples of 3 varieties of each being submitted to milling experts for their judgment. The average markings were as follows: *Hard wheats*—Turkish Red 99, Buda Pesth 97, and Bulgarian 96; *soft*—Hybrid Prolific 90, Early Ripe 82, and Kentucky Giant 85. It will be noticed that the first 3 wheats mentioned were almost equal in quality to the best spring wheats.

In cultural tests Turkish Red wheat grown after rape yielded at the rate of 59.8 bu. per acre; grown after flax, 58; after buckwheat, 55.3; after millet, 54.7 bu. per acre. Oat stubble was prepared for wheat by plowing under early in August. It was then worked down with a harrow and roller and harrowed once a week thereafter until the wheat was sown in September. Manuring for wheat is not advised. It resulted at the station in considerable lodged grain. From the results of trials in seeding wheat at different dates in September, the author recommends the sowing of wheat as soon after the first week in September as there is moisture enough in the soil to germinate the seed.

When clover or timothy is seeded with wheat, both should be sown in the spring and harrowed in. Fall sowings are liable to winterkill. Seedings of winter oats have uniformly winterkilled at the station, and farmers are advised to plant this crop, if at all, only in very small quantities. United action by farmers in burning over spring-wheat stubble where the Hessian fly is troublesome, followed by deep plowing, is urged as means for the control of this pest.

Diversified farming in Oklahoma, J. Fields (*Oklahoma Sta. Rpt. 1900, pp. 33–44, figs. 3*).—The chief features of present Oklahoma methods of farming are outlined, suggestions being given regarding the desirability of more diversified farming, and the culture and value of several staple crops for this purpose.

Seed selection, E. Gain (*Sta. Agron. Nancy Bul. 3, 1900, pp. 16–25*).—A popular consideration of the principles involved, methods to be followed, and the value of seed selection in increasing the yield of farm crops.

The assimilation of matter by two cultivated plants, A. von Sigmond (*Jour. Landw., 48 (1900), No. 3, pp. 251–264*).—Preliminary observations on the increase of dry matter and the taking up of total ash constituents, and nitrogen by maize and tobacco are reported and discussed. The investigations are to be prosecuted further before conclusions are drawn.

Field experiments at Grignon, P. P. Dehérain (*Ann. Agron., 26 (1900), No. 8, pp. 369-383*).—Data secured in variety, fertilizer, and irrigation experiments with potatoes, beets, sainfoin, and alfalfa during the unfavorable season of 1899 are recorded.

Field crop tests, H. T. French (*Idaho Sta. Bul. 24, pp. 13-18*).—Notes and tabulated data on the successful culture at the station of potatoes, millet, and Dwarf Essex rape. Of 134 varieties of potatoes tested, the varieties Cream City, Ford No. 1, Large Puritan, Cambridge Prolific, and Rural New Yorker No. 2, with yields of 384, 356, 349, 342, and 301 bu. per acre, respectively, were the most prolific sorts.

Cost of growing corn, B. W. Snow (*Amer. Agr. (mid. ed.), 65 (1900), Nos. 25, pp. 739, 740; 26, p. 764; 66 (1900), Nos. 1, p. 4; 2, p. 28; 3, p. 52; 4, p. 76*).—Statistical data as to the cost of the various cultural operations in growing 4,051 acres of corn in 21 States.

Culture experiments with different varieties of lupines, Edler (*Landw. Wchnbl. Schleswig-Holstein, 50 (1900), No. 30, pp. 518-521*).—Yellow, black, blue, and white varieties of lupines were grown comparatively on sandy and sandy loam soils. Data as to yields, time of blossoming, alkaloid and albuminoid content of the seeds, etc., are recorded.

Winter oats, M. Fischer (*Fühling's Landw. Ztg., 49 (1900), Nos. 19, pp. 718-732, figs. 3; 20, pp. 766-771, figs. 3; 21, pp. 806-810*).—The close relation between winter oats and wild oats and the apparent frequent degeneration of the former to the latter forms are discussed.

Seed potatoes from different soils, Duke of Bedford and S. U. Pickering (*Woburn Expt. Fruit Farm Rpt. 1900, pp. 236, 237, 258*).—In this experiment tubers which have been grown in one instance on light soil and in another on heavy soil were used for seed in comparison with home-grown tubers. The yields obtained from the home-grown tubers were on the average 8 per cent higher than those obtained from the imported seed.

Crops of potatoes obtained from sets of different sizes, Duke of Bedford and S. U. Pickering (*Woburn Expt. Fruit Farm Rpt. 1900, pp. 233-235, 258*).—Large, medium, and small whole tubers of 3 different varieties were used for seed. The best results in each case were secured from the medium size potatoes, the increase being 24 per cent heavier than from small seed and 34 per cent heavier than from large seed. No difference in the size of the tubers obtained from planting different size seed was observable.

The effect of planting potatoes at different times, Duke of Bedford and S. U. Pickering (*Woburn Expt. Fruit Farm Rpt. 1900, pp. 228-232, 258*).—Planting potatoes in midseason—about the end of April—has given better average results than planting either earlier or later. The Bruce has been the most satisfactory variety grown.

Sugar plants, L. Geschwind (*Ann. Agron., 26 (1900), No. 8, pp. 383-409*).—A popular consideration of the nature of sugar-producing plants under the following heads: (1) Plants containing sugar, but of little if any industrial importance, such as carrots, melons, agaves, etc.; (2) plants used in the production of sugar on a small scale, like palms, corn, sorghum, and sugar maples; and (3) plants utilized in the manufacture of sugar industrially, *i. e.*, cane and sugar beets.

The sugar-beet industry in New York, C. A. Wieting (*Rpt. New York State Dept. Agr., 6 (1899), I, pp. 101-118*).—The history of the development of the sugar-beet industry in New York is briefly noted, and an account given of cultural experiments in 1897 and 1898. The sugar-beet factories located at Rome and Binghamton in the State are described.

Conservation of beet tops (*Deut. Landw. Presse, 27 (1900), No. 89, p. 1088*).—Different methods of conserving sugar-beet leaves for fodder, as drying, collecting in heaps and fermenting, feeding green, etc., are considered.

Some experiences with seedling canes in British Guiana, F. J. Scard (*West Indian Bul., 1 (1900), No. 4, pp. 380–386*).—A number of promising seedling canes have been grown in comparison with the Bourbon variety. The results obtained have been contradictory.

Tobacco culture, J. C. Espin (*Bul. Bot. Dept. Trinidad, 1900, Oct., pp. 291–304*).—This bulletin deals popularly with the culture of tobacco, including harvesting, curing, packing, and baling in Cuba and neighboring islands.

Experiments with grain and the necessity of regularly conducted field-fertilizer experiments, M. Fischer (*Fühling's Landw. Ztg., 49 (1900), Nos. 6, pp. 220–229; 7, pp. 248–256*).—Fertilizer experiments with wheat after potatoes and with oats are reported, the purpose of which is to show that because of the wide variation in soils and conditions of different localities, each farmer must carry out his own experiments on his farm. Before beginning such an experiment, a definite plan should be outlined. A general scheme is submitted covering fertilizer trials on light and heavy soils. The 3 points covered are (1) determining the fertilizing elements needed; (2) the most profitable amount of fertilizer; and (3) the most suitable form of the fertilizer.

Experiments on wheat at Ghizeh, G. P. Foaden (*Jour. Khediv. Agr. Soc. and School Agr., 2 (1900), No. 4, pp. 160–169*).—In variety tests at the station Indian wheats have been found much superior to the ordinary wheat of Egypt. Much better crops have been secured by watering twice, *i. e.*, when the crop is about 14 in. high and just when the flowering stage is reached, than when only 1 watering is given. When the crop is not watered at about the time it is coming into ear, the grain is often small and shriveled in appearance. In the fertilizer experiments the most beneficial results were obtained by the use of nitrate of soda.

Analyses of varieties of wheats (*Ann. Agr. Suisse, 1 (1900), No. 2, pp. 74, 75*).—Analyses, with reference to protein, of 30 varieties of wheat.

Weak straw, J. A. Murray (*Ann. Rpt. Field Expts., Univ. Col. Wales, 1899, pp. 79, 80; abs. in Jour. Chem. Soc. [London], 78 (1900), No. 453, II, p. 498*).—Analyses are reported of two lots of rye straw (1) manured with phosphates, nitrogen, and potash, and (2) with phosphates and nitrogen only. The straw in the latter case was too weak to stand, and when dried was so brittle that it could almost be reduced to powder by crushing in the hand. Results indicate that the weakness of the straw was probably due to a deficiency of oil.

HORTICULTURE.

On the limits of the possibility of grafting plants, L. Daniel (*Compt. Rend. Acad. Sci. Paris, 131 (1900), No. 3, pp. 192, 193; Jardin, 14 (1900), No. 325, pp. 271, 272*).—An account is given of 12 unusual unions between plants belonging to different families, obtained by grafting by approach. Successful grafts were made between seedlings of the following plants: Kidney bean and cocklebur, kidney bean and castor-oil bean, sunflower and melon, cabbage and tomato, chrysanthemum and tomato, Jerusalem artichoke and black nightshade, coleus and acaranthus, cineraria and tomato, aster and phlox, coleus and tomato, maple and lilac, zinnia and tomato.

The most perfect grafts in these experiments were made between plants nearest alike in vigor and vegetation. The nature of the tissue of the different plants also played an important rôle. The tomato and

cabbage and the artichoke and nightshade gave good unions on account of their herbaceous nature and rapid growth, while astor and phlox, somewhat advanced in growth, and year-old maple and lilac united with difficulty except on very young shoots.

The success of these experiments leads the author to conclude that the old idea that only plants belonging to the same family can be grafted on each other does not apply to grafting by approach.

Preventing frost injuries by whitening (*Pacific Rural Press, 60 (1900), No. 18, p. 276*).—The text is here given of a paper prepared by J. C. Whitten for the American Pomological Society. The earlier work of the author along this line is reviewed (E. S. R., 9, p. 835), and results secured in 1898–99 added. In order to measure the difference in temperature between the whitened and natural colored buds, fruit twigs of the summer's growth were bored out for about 4 in. of their length and slender thermometers inserted. The twigs were tied so they would all stand vertically and thus receive the sun's rays at the same angle.

"During stormy weather the natural twigs registered a higher temperature than the whitened ones. During very bright sunlight in midday the natural twigs were 15° warmer than the whitened ones. The whitened twigs were nearly of the same temperature as the atmosphere. When the sun came out suddenly bright, however, the whitened twigs did not warm up so rapidly as did the atmosphere. The difference of 15° in temperature explains why whitened twigs do not swell enough to endanger themselves to subsequent injury from cold."

Report on the condition of olive culture in California, A. P. Hayne (*California Sta. Bul. 129, pp. 34, pls. 5*).—The generally unsatisfactory state of the olive industry in California induced the station to make investigations as to the causes of the depression. Growers and manufacturers in all parts of the State were visited and the culture and commercial status of the olive studied.

The causes of failure in olive culture were found to be improper selection of soil, neglect of tillage, irrigation, proper pruning, and of controlling insect pests. Commercial conditions tending to harm the industry were competition with cotton-seed oil and other oils sold as olive oil, poor harvesting and manufacturing methods, and the selection of unsuitable varieties. Each of these factors is taken up and discussed, and suggestions offered regarding the principles, and, in many instances, the details to be observed in the different operations of successful culture and manufacture. In pruning, care should be taken to have plenty of one-year-old wood on the tree. Vertical branches should be deflected to induce fruiting, and feeble trees renewed by pruning for wood branches. Low pruning is generally advised, except in low, frosty land. The use of about a dozen stands of bees in each 20 acres of orchard at blooming time has proven practical in insuring a good "set" of fruit.

The black scale (*Lecanium oleæ*) with its accompanying fungus, the black smut (*Meliola* sp.), as well as some other scales, were found in olive orchards, most frequently along the coast, in the foggy region. They have been successfully combated by washes, fumigation, and in some instances, by the Australian ladybird. A disease of the fruit, first observed in California in 1897 and since spread all over the State, is noted. It is described as a dry rot, and manifests itself in 3 ways: (1) "It starts at the blossom end and works toward the stem end of the drupe, finally causing it to fall to the ground or dry out on the tree. (2) The decomposition of the flesh cells and the destruction of their contents is first noted at the pit itself, from which point it works outward until it reaches the skin. (3) The decomposition seems to start at the outer surface of the drupe in small isolated spots, from which it works inward until it reaches the pit."

Each of these diseases seems to be restricted to certain varieties. Thus, in the first instance, the varieties Nevadillo Blanco, Rubra, and Pelureur de Grasse are attacked; in the second, Mazanillo, Obliza, and some of the large, fleshy olives; and in the third, the variety Columbella.

The author states that the production of olive oil can not be made profitable unless the grower receives at least 75 cts. per quart for this product. A good demand for large, sound olives for ripe pickles was found to exist all over the State at 75 cts. per gallon, with lower prices for smaller grades. There was a steady market also for standard size green pickles. The author believes olives should be grown for pickles and the small size disposed of to oil makers.

Pickling olives is discussed in considerable detail, as is also the preservation of the product from bacterial growths. The essential factors in pickling are care and skillfulness. The fruit used should be graded for size and color and not be bruised. The latter item was found to be the most general cause of all the failures investigated. The varieties Sevillano, Ascolano, St. Agostino, Cucco, Polymorpha, Macrocarpa, Obliza, and all the very large, fleshy olives are so delicate that they are used almost entirely for green pickles. Large Mission is considered the best variety for ripe pickles for marketing. The value of other varieties for different purposes is noted.

Both pure water and lye processes of extracting the bitterness or tartness of olives are described and formulæ given for salting, etc.

E. W. Hilgard makes the following remarks on the general subject of pickling in conclusion to the bulletin:

"The stronger the lye used in extracting the tartness of the olive the more the flesh is softened and the more difficult it will be to make the pickle keep. Moreover, the stronger the lye, and therefore the shorter the time of extraction, the greater the liability to its being overdone or underdone. It is far better, by repeatedly using a weak lye, say not exceeding 2 oz. per gallon, to prolong the time of extraction and thus to be able to gage exactly and leisurely the right moment for stopping the process.

I should never expect any fruit extracted within 4 or 5 hours to keep beyond 6 months. As many days will be found to be a wiser economy in the end, the weak lye being removed as often as may be found necessary by its becoming saturated with the 'tartness.' This is easily determined by its ceasing to feel 'soapy' between the fingers. This test is also useful in case an impure 'concentrated lye' has been used.

"The use of salt brine is advisable at any time when the fruit appears to be softening too much, which may readily happen, especially in the case of that which has been grown on low or over-irrigated ground, where it becomes pulpy and large. Such fruit can be firmed, and properly reduced in size, and made to keep by the timely use of brine of properly graduated strength. This use need not be deferred until after the lye has been washed out; the salt in nowise interferes with its action. I consider close attention to this point of extreme importance in respect to the keeping qualities of ripe pickled olives; and it is readily seen that here again the use of good judgment and close observation is of the utmost importance, and that no routine prescription will answer.

"Different varieties of olives must never be treated together. When one is done just right another will be found overdone or underdone. The same consideration applies to fruit of greatly different sizes. No uniformity of texture, flavor, or color can be expected when different varieties and sizes are pickled together."

Small fruits in 1899, G. C. Butz and J. F. Pillsbury (*Pennsylvania Sta. Bul. 51, pp. 6*).—Results are here reported of tests of 61 varieties of strawberries, 39 of which are described, 30 raspberries, 25 blackberries, 12 currants, and 12 gooseberries. Earlier work at the station with the same fruit has been noted (E. S. R., 11, p. 452). The strawberry crop for the season was unsatisfactory, owing to dry weather and consequent small yields.

A comparison was made of the matted row and hill systems of cultivation to determine their relative merits in the production of large-sized berries. The results show that with a little more than one-half of the varieties grown the increase in size of the berries in the hill system of culture over the matted row varied from 0.02 gm. to 4.44 gm. per berry, while with the remainder the increase in favor of the matted row varied from 0.11 to 2.63 gm. per berry.

Summer pinching has been the system of pruning used with raspberries and has proven very satisfactory. All the varieties are kept at a height of 2½ ft. except Shaffer Colossal and Columbian, which are allowed to grow 3½ ft. high.

Liquid dressings applied to strawberries during the fruiting season, Duke of Bedford and S. U. Pickering (*Woburn Expt. Fruit Farm Rpt. 1900, pp. 83–92, 251*).—Six different plats, each containing 528 strawberry plants, received liquid dressings during the time the fruit was swelling, as follows: Nothing, water only, and water with either ammonium sulphate, sodium nitrate, potassium nitrate, or ammonium sulphate mixed with sulphate of iron, respectively. The manure applied in the different cases was equivalent to an application of about 15 tons of London city manure per acre. Each plant received about a quart of the different solutions, applied weekly throughout the month,

a quantity equivalent to about 0.1 in. of rain, and therefore possibly not sufficient to insure the proper effect of the nutrients dissolved in it.

"The dressings had a retarding influence on the ripening of the crops, especially with one year plants, owing probably to the period of growth being prolonged thereby. The results with the crops during 4 seasons do not prove decisively the existence of any benefit from such dressings. The 2 plats dressed with nitrates and also that which received iron sulphate show a possible excess of 10 to 34 per cent over the undressed plats, but the differences on which this effect depend are uncertain, inasmuch as they are not greater than those between the 2 sections of the undressed plats."

Manurial experiments with strawberries, Duke of Bedford and S. U. Pickering (*Woburn Expt. Fruit Farm Rpt. 1900, pp. 93–97, 251, 252*).—As this experiment has been conducted for only 3 years, it is stated that the results are quoted with considerable reservation. The soil used was light in character. There were 6 plats each made up of 288 plants. One plat received no fertilizer, 2 received 12 and 30 tons, respectively, of London city manure, and the remaining 3 plats a mixture of mineral fertilizers and nitrate of soda in quantities equivalent to the above amounts of London city manure and applied fractionally. The purpose of the test was to ascertain the respective merits of city manures and commercial fertilizers and the effect of altering the amounts applied.

On the whole the different dressings have had but little influence on the crops, the excess obtained from the manured plats for the 3 years being on an average but 5 per cent. One year the yield from the fertilized plats was 11 per cent less than from the nonfertilized, while in 2 other years the increase was 27 and 8 per cent, respectively. The London city manure gave slightly better results on the average than were obtained from the use of commercial fertilizers and slightly higher results, especially the first year, were secured with applications of 30 than with 12 tons. "With artificial manures the indications of the effect of increasing amounts are pretty well balanced in opposite directions in different seasons, the mean result for the 3 years showing a small but insignificant balance in favor of the smaller dressing."

Rubber cultivation for Porto Rico, O. F. Cook (*U. S. Dept. Agr., Division of Botany Circ. 28, pp. 12*).—This circular is a part of a report now in preparation on the useful plants and agricultural possibilities of Porto Rico. Rubber stands third in importance of the commercial products of vegetable origin now imported into the United States, the receipts during 1899 being valued at $32,500,000. At the present time the largest amounts of rubber are obtained from the tropics of Africa and South America. The extent of the wild supply is unknown, since large portions of these countries have not yet been explored either geographically or botanically. This factor, taken in connection with the possibility that new species will be discovered

which will yield rubber more profitably, the possibility of the discovery of new synthetical methods for producing rubber from turpentine or of methods for extracting a substitute from certain rapid-growing shrubs, as "*Synatheraeas mexicanas*," the many failures in part or wholly that have attended attempts to build up plantations outside of the natural rubber districts, and the increased cost of using civilized help in the management of tropical plantations, suggests caution in investing large sums of money in the rubber industry. The fact that a species may grow luxuriantly in a new district seems to be no indication whatever that it will profitably produce rubber. Usually the opposite results follow. From 5 to 15 years is given as the probable time required for the growth of rubber trees before they can be tapped for rubber.

The botanical sources of rubber are discussed, and mention made of experiments, generally unsatisfactory, in cultivating Para rubber (*Hevea brasiliensis*), Ceara rubber (*Manihot glaziovii*), and Central American rubber (*Castilloa elastica*) in regions outside of the native habitat of the species. Rubber culture as a feature of mixed farming is thought to be the most rational method to follow in Porto Rico until the possibility of its successful production is more definitely established. Experimental plantings of the most promising rubber trees now known and of new sorts as fast as they are discovered by planters to be carried on in connection with other farming are advocated.

Other factors in rubber production, such as harvesting and coagulating the latex, are touched upon and concluding general notes given on the future of rubber culture.

How to store winter cabbage, A. G. MILLER (*Rural New Yorker, 59 (1900), No. 2648, p. 718, fig. 1*).—Directions are given for building a cellar for storing winter cabbage. Methods of handling the cabbage before being stored are also noted.

Lima bean growing in Ventura County, E. P. HALL (*Pacific Rural Press, 60 (1900), No. 12, pp. 181,182*).—A discussion of cultural methods in Ventura County, Cal.

Tomato tests on the American Gardening grounds (*Amer. Gard., 21 (1900), No. 311, pp. 805, 806*).—Of 46 varieties grown during the season, Stone has again been found preeminently the best all-around sort. Trucker Favorite is another good variety. This has a pink skin and is preferred to Beauty, a very similar tomato, but smaller and with a tendency to crack at the base. Other varieties mentioned are Royal Red, Trophy, Early Michigan, and Honor Bright. Enormous is good for exhibition purposes. Golden Jubilee proved by far the best of the yellow varieties tested, and Burpee Cluster the best of the small-fruiting or cluster kinds.

Analyses of some edible mushrooms (*Ann. Agr. Suisse, 1 (1900), No. 2, pp. 73, 74*).—Analyses with reference to dry matter and protein are given for 10 species of edible mushrooms.

The effect of pollination, N. KEEP (*Canad. Hort., 23 (1900), No. 12, pp. 515–517, figs. 2*).—The effect on the fruit of planting Keiffer and Duchess pears in alternate rows is discussed and illustrations given of the cross pollinated fruit. The quality of the Duchess was impaired by cross pollination with Keiffer; but Keiffer was much

improved in quality, color, and especially in form and appearance, by cross pollination with the Duchess.

Grafting with fruit bud twigs, C. Trébignaud (*Jardin, 14 (1900), No. 328, pp. 312–315, figs. 2*).—The utility of this method of grafting, conditions on which success depends, method and best time of making the graft, etc., are considered. The author found it valuable in growing the choicer varieties of pears. Vigorous trees which fail to produce fruit may be grafted with fruit buds from other trees in August or September, and fruit obtained on the twigs the following season.

Variety tests of fruit, O. M. Morris (*Oklahoma Sta. Rpt. 1900, pp. 116,117*).—A list of the varieties of apples, pears, cherries, plums, apricots, and peaches that set fruit at the station in 1900.

The pruning of the lemon, C. W. Leffingwell, Jr. (*California Cultivator, 15 (1900), No. 13, pp. 193, 199, 200*).—Popular discussion of California methods.

Pruning the lemon tree, R. C. Allen (*Pacific Rural Press, 60 (1900), No. 13, p. 197*).—Discussion of principles and methods.

Budding orange trees, W. Cardwick (*Bul. Bot. Dept. Jamaica, n. ser., 7 (1900), No. 11, pp. 169–172, fig. 1*).—The preparation of lemon, shaddock, and large sour orange trees for budding, the condition of trees from which sweet orange buds are to be taken, and methods of budding are popularly discussed.

The olive in Algeria, Trabut (*Bul. Agr. Algérie et Tunisie, 6 (1900), Nos. 16, pp. 425–472, figs. 32; 17, pp. 481–508, figs. 15*).—An historical account is given of olives and varieties in Algeria, with extensive notes on methods of propagation and the manufacture and commerce of olive oil.

Germination of the olive, G. Sani (*Atti R. Accad. Lincei. Cl. Sci. Fis. Mat. e Nat., 9 (1900), I, pp. 47–51; abs. in Jour. Chem. Soc. [London], 78 (1900), No. 455, II, p. 613*).

Manurial experiments with bush fruits, Duke of Bedford and S. U. Pickering (*Woburn Expt. Fruit Farm Rpt. 1900, pp. 98–105, 252*).—Data are recorded of fertilizer experiments with different amounts of London city manure and certain commercial fertilizers for gooseberries, currants, and raspberries. The results obtained are largely negative owing to the soil being sufficiently supplied with all the different elements of plant food.

Fruit pulp, W. Boulter (*Ontario Fruit Growers' Assoc. Rpt. 1899, pp. 116, 117*).—The report of a committee appointed to study the desirability of shipping raspberries as pulp into England. If the berries will bring 5 cts. per quart at home it is not advisable to ship abroad as pulp.

Grape growing, O. M. Morris (*Oklahoma Sta. Rpt. 1900, pp. 90–103, figs. 10*).—A popular treatise on the propagation, cultivation, pruning, and trellising of grapes. Grapes have proven the most uniformly hardy and productive of the fruits grown in Oklahoma. Moore Early, Concord, and Worden are considered the 3 best black grapes; Delaware and Catawba the best red grapes; and Niagara, Moore Diamond, and Goethe the best white or pink grapes, the varieties under each color being mentioned in the order of earliness. Grapes that are gaining favor are Herbemont, Jaeger Cottage, and Brilliant, while Rommel, Admirable, Early Ohio, Fern Munson, and Green Mountain are other especially promising varieties.

Viticulture in Hérault in 1900 (*Bul. Soc. Cent. Agr. Hérault, 87 (1900), Jan.–June, Append. pp. 90, figs. 25*).—A symposium composed of the following papers: Production and consumption of wine in Hérault, J. Leenhardt-Pomier; Vines, L. Ravaz; Cellars, P. Ferrouillat; Climatic conditions, F. Houdaille; Geology of the region, H. Lagatu; Composition of the wines, L. Roos; and The historic and economic situation of viticulture, Coste.

American vines and the phylloxera situation in Switzerland, J. Dufour (*Ann. Agr. Suisse, 1 (1900), No. 1, pp. 44, figs. 11*).—The nature of the different American grapes used for stocks in districts affected by the phylloxera and methods

of propagating them are described in the first part of this work, while in the second part some results obtained in experiments with different American species and hybrids to determine their relative value on different soils in the Canton de Vaud are recorded.

Chestnut culture, E. B. ENGLE (*Pennsylvania Dept. Agr. Rpt. 1899, pt. 1, pp. 301–312, figs. 10*).—Popular discussion of the culture, propagation, insects, diseases, and varieties of chestnuts. With reference to propagation the author states that "seedlings grown from Paragon nuts grow more vigorously, form a better union, and make a larger percentage of good trees than seedlings grown from native chestnuts."

Cacao industry in Grenada, G. W. SMITH and D. MORRIS (*West Indian Bul., 1 (1900), No. 4, pp. 415–422*).—Suggestions regarding the management of cacao groves and the renovation of old plantations.

Walnut culture in California, J. M. DICKENSON (*California Cultivator, 15 (1900), No. 12, pp. 177, 183, fig. 1*).—Culture and management.

Notes on the Gladiolus, H. H. GROFF (*Amer. Gard., 21 (1900), Nos. 304, p. 698; 310, pp. 792, 793; 312, p. 830; 313, pp. 848, 849*).—The characteristics of different strains and hybrids are discussed.

A summer's work abroad, in school grounds, home grounds, playgrounds, parks, and forests, MIRA L. DOCK (*Pennsylvania Dept. Agr. Bul. 62, pp. 33, pls. 9*).—The author visited England, Edinburgh, and Germany, and spent a few days in Switzerland and Paris. Six public bath houses, 14 school buildings, and 110 parks and playgrounds were visited and a tour made through the Black Forest. The more striking features met with in the journey are recounted and furnish much suggestive matter relative to the management and improvement of Pennsylvania school grounds, public parks, and forests, as well as similar institutions in other States.

FORESTRY.

Miscellaneous notes in botany and forestry, W. A. BUCKHOUT (*Pennsylvania Sta. Rpt. 1899, pp. 245–256, pls. 5, fig. 1, charts 3*).—The writer reports upon the time and rate of formation of the annual ring of wood in the European larch and the white pine. Observations were made during the years 1897, 1898, and 1899. In the case of the larches the growth of wood began during the last week in April, with seasonal differences due to temperature, moisture, etc., although their effect was hardly appreciable. The beginning of wood formation practically coincided with the appearance of new leaves on the larch. Diagrams are given showing the variations in seasonal growth with both species. The absolute growth of the white pine was considerably greater than that of the larch, and the growing season of the pine continued into September while the larch made little or no growth after July. The pine showed greater uniformity in amount of yearly growth, only $\frac{1}{16}$ in. difference occurring during the 3 years in question, while the larch showed a difference amounting to $\frac{3}{16}$ in. It is thought probable that the specimens of larch taken for the experiment were hardly representative, as from their appearance they had probably passed the time of maximum yearly growth. While there have not been sufficient experimental plantings to give definite data, the author believes that the larch, while not as long-lived or producing as great a bulk of wood as the pine, can be advantageously grown for many purposes.

Notes are given on the depreciation of forest trees and results of the failure to cut trees at maturity. Numerous examples are given of depreciation in value attributed to decay, and various signs of decay are pointed out.

The undesirability of red and black oaks, because of fungus diseases, is mentioned. These oaks, particularly the black oak, are specially subject to a disease of the same nature, if not identical, with the canker of the apple tree (*Nectria ditissima*). It is said that few trees incurring this disease overcome or outgrow it and, as a rule, they fail completely before attaining a diameter of 10 in. at the base. The disease is much more common in sprout or coppice growth than in seed-grown trees. A judicious selection should be continually carried on during the early years of forest growth, cutting out the undesirable species and particularly every tree which shows the beginnings of disease. The white oak seems to be entirely free from this disease, while most of the other species are affected to a greater or less degree.

Notes are given on the injury produced on white pine by the pine weevil. It is said that one of the most serious obstacles to the growth of the white pine is the pine-tree weevil (*Pissodes strobi*), a small beetle which lays its eggs in the young terminal shoots and occasionally in the uppermost laterals. The young grubs bore through the bark to the wood, completely destroying the shoots. The ravages of this insect are said to be very common, destroying during the past year the tops of at least 10 per cent of the white pine trees, as well as seriously attacking Norway spruce and other ornamentals.

Notes are given on various shade trees for street planting. The tulip and magnolia on good loamy soils, with plenty of room and good drainage, are said to be well adapted to this purpose. They should not be set closer than 50 ft., and 60 ft. is better. The same conditions apply to the sycamore and elm trees. Maple trees vary considerably with the different varieties. The silver maple gives the quickest results with possibly one exception of any shade tree, but for best growth requires a moist fertile soil. The hard maples are considered among the most desirable for shade trees, succeeding well on a variety of soils, and are believed to be nearly free from insect or fungus attacks. The European species, while generally more rapid in growth during early life, are said to soon reach the limit of growth and never make as large trees as the American species.

The cottonwood and other poplars, on account of their rapid growth, are frequently recommended for street trees, but they do not last as well as some other varieties and become very unsightly with age. The tendency to sprout from the root is also considered objectionable. The objections urged against the cottonwood are said to apply to ailanthus, and in addition this tree has an irregular habit of branching, so that old trees become very unsymmetrical.

Report of the commissioner of forestry, J. T. Rothrock (*Pennsylvania Dept. Agr. Rpt. 1899, pt. 1, pp. 123-139*).—Brief accounts are given of forestry operations which have been begun. An attempt has been made to start plantations of Carolina poplars (*Populus deltoides*) for paper manufacture. Attention is called to the value of the chestnut as a source for tanning extracts, and the effect of forest fires in destroying this crop.

The losses by forest fires in Pennsylvania during the year 1898 are mentioned, from which it appears that 22,853 acres were burned over at a loss of $53,000. The timber cut during the same period was 130,000 acres, including 107,000,000 ft. (b. m.) of white pine, 858,000,000 ft. of hemlock, 416,000,000 ft. of other lumber, and 534,000 cords of bark peeled.

An estimate is made of the timber lands as they now exist in the State, the area being given by counties. From the tabular statement given, it appears that there are 2,765,000 acres of full-grown timber land, 2,944,000 acres of half-grown timber land, and 4,443,000 acres of brush land.

Some cooperative experiments with forest tree seeds, G. C. Butz (*Pennsylvania Sta. Rpt. 1899, pp. 227-244*).—A report is given of cooperative experiments begun in the fall of 1896 in connection with the Division of Forestry of this Department. The plan of the experiment was to study the climatic effect upon several widely distributed species of forest tree seedlings. The species chosen for the first year's planting were black walnut, bur oak, hickory, honey locust, box elder, green ash, and white ash. Tabulated data are given showing the results of the different plantings, in which the time of germination, height of tallest seedlings, average rate of growth, effect of spring frost, and date of fall of the leaves of each species are given. Comparisons are noted showing the results of fall and spring planting of seeds. The spring planted seeds were stratified during the winter, and in the case of the walnut, bur oak, box elder, and white ash, the spring planting gave the highest average of germinations.

Forest protection and restoration, T. P. Lukens (*Forester, 6 (1900), No. 5, pp. 100, 101*).—The forest conditions of southern California are briefly reviewed, and it is urged that means should be taken to repair the injury due to forest fires, overpasturing, etc. In reforesting this region, the author suggests the planting of pine seeds on burned areas as soon as possible, in order that the trees may keep above the brush growth which follows forest fires. Growing at different altitudes, it is said that different species of pines, cedars, spruces, and firs may be found adapted to the conditions found in that region. This reforestation, it is believed, can be done at no great expense, $20 per acre being the estimated cost of seed and all labor.

Forest influence on water flow, H. S. Graves (*Forester, 6 (1900), No. 5, pp. 113, 114*).—A brief report is given of an investigation of the

Mill Creek watershed in Pennsylvania. As a result of this investigation it is stated that a more uniform flow of water can be obtained by proper management, and in addition the forest can eventually be made a source of considerable income. The entire watershed was originally covered with hemlock and mixed hard woods, although at present no considerable area of the virgin forest remains. About four-fifths of the entire tract has grown up in second growth, and one-fifth is or has been recently under cultivation. It is suggested that this region should be replanted, the large open areas with white pine, alternating with fields seeded to black locust, in which oaks and chestnuts should be planted later. Under the system of planting and management suggested it is believed that within 10 or 20 years many of the trees would become of marketable size, so that it would be a source of considerable income to the management.

Tree planting (*Oklahoma Sta. Rpt. 1900, pp. 118, 119, fig. 1*).—The results of the tree-planting operations of the station for the year are briefly reviewed, in which the number of trees planted in February, 1900, and those living June 1 are given. The trees were young seedlings and set in rows 4 ft. apart and from 2 to 4 ft. apart in the row. In all, 35,000 trees of the following varieties were planted: White elm, soft maple, catalpa, black locust, box elder, white ash, and honey locust. The proportion of those dying from varying causes ranged from 2 per cent in the case of the soft maples to 65 per cent in the case of the white ash.

Sowing tree seeds, etc., Pinehurst Nurseries, N. C. (*Amer. Gard., 21 (1900), No. 304, pp. 693, 694*).—Directions as to time and method of planting a large number of trees and shrubs.

The forests of Indiana, J. P. Brown (*Forester, 6 (1900), No. 5, pp. 110–113*).—An address in which the past and present conditions of the forest of the State are reviewed. Notes are also given on the rate of growth and durability of a number of species of trees.

Forest conditions in the Klondike (*Sci. Amer. Sup., 49 (1900), No. 1267, pp. 20311, 20312*).—Popular description of the forests of the interior of Alaska and adjacent regions.

The pine forests of northwestern Germany, Erdmann (*Allg. Forst u. Jagd Ztg., 76 (1900), Jan., pp. 11–22*).—Describes the pine forests occurring upon the clay regions of northwestern Germany.

Forest management in Germany, Eberts (*Allg. Forst u. Jagd Ztg., 76 (1900), pp. 50–56, 102–106, 167–170, 197–200*).—The systems of forest wardens and management for Hesse, Mecklenburg-Schwerin, Meiningen, Saxony, and Wurttemburg are described.

Some forest problems in northwestern Russia, H. Mayr (*Allg. Forst u. Jagd Ztg., 76 (1900), pp. 81–91; 117–131, 156–160*).—The forests, their value, and their necessities are described.

Investigations of the more important deciduous trees of Japan, S. Kawai (*Bul. Col. Agr. Imp. Univ. Tokyo, 4 (1900), No. 2, pp. 97–152, I–IX, 11–18, pls. 9*).—The timber characteristics of a large number of the deciduous trees as shown by cross radial and tangential sections and bark appearance are given.

The genus Tilia in Japan, H. Shirasawa (*Bul. Col. Agr. Imp. Univ. Tokyo, 4 (1900), No. 2, pp. 153–165, pls. 2*).—The Japanese species of Tilia are mentioned and 2 new species described, *T. kiusiana* and *T. maximowicziana*.

The forests of Java and their exploitation, Seibt (*Allg. Forst u. Jagd Ztg., 76 (1900), pp. 160–167, 192–197, 236, 241, 271–279*).—The wooded area of the island

is estimated at 126,447 square kilometers. The rainfall and climate are discussed, the forests described, the relative value of the woody species indicated, and methods of management described.

Mixed forests of pine, fir, and larch, REISS (*Allg. Forst u. Jagd Ztg., 76 (1900), June, pp. 189–192*).—The requirements of each species are described, their value as components of mixed forests mentioned, and methods suggested for securing such mixtures.

On the growth of oak and other deciduous species in beech forests, H. BERTOG (*Ztschr. Forst u. Jagdw., 32 (1900), No. 4, pp. 188–212, figs. 10*).—Notes on the requirements and growth of various species of oak, ash, maple, etc., growing in beech forests.

Comparative ash analyses of red fir and European spruce, E. HOPPE (*Centbl. Gesam. Forstw. Wien, 26 (1900), No. 2, pp. 49–54*).—Comparative ash analyses of *Pseudotsuga douglasi* and European spruce are given.

Physiological investigations on the increase in diameter and the quality of the timber of Pinus sylvestris, F. SCHWARZ (*Physiologische Untersuchungen über Dickenwachstum und Holzqualität von Pinus sylvestris. Berlin: P. Parey, 1899, pp. 371, pls. 9, figs. 5; noted in Allg. Forst u. Jagd Ztg., 76 (1900), Mar., pp. 106–110*).

On the estimation of the yield of oak forests, WIMMENAUER (*Allg. Forst u. Jagd Ztg., 76 (1900), Jan., pp. 2–9*).—Tables are given for estimating the yield of oak forests. The characteristics of the various forests where the tables have been tested are given. *Quercus pendunculata* and *Q. sessiliflora* were the dominant species, with beech, ash, alder, linden, elm, and several conifers forming the secondary growth.

Rapid estimation of the cubic contents of fir trees (*Rev. Eaux et Forêts, 3. ser., 4 (1900), No. 1, pp. 17–21*).—Formulas are given for the estimation of the contents of workable timber in fir trees. It is based upon the rule that the cubic contents of a fir tree 24 meters in height equals 10 times the square of the diameter of the tree at the height of a man.

An international commission on timber physics, SCHWAPPACH (*Ztschr. Forst u. Jagdw., 32 (1900), No. 4, pp. 230–233*).—An account is given of previous attempts in the formation of such an international commission for securing uniformity of methods.

The influence of forests upon the temperature of the air, MUTTRICH (*Ztschr. Forst u. Jagdw., 32 (1900), No. 3, pp. 147–167*).—Gives records made at periods of 2 hours daily for 3 years in which the temperature of a forest and an open field are compared.

Pasturing forests, A. MATHEY (*Le pasturage en forêt. Dijon, 1900; rev. in Rev. Eaux et Forêts, 3. ser., 4 (1900), No. 5, pp. 156–158*).—The results of the author's personal observations upon the effect of pasturing forests.

Annual review of the literature of forestry, T. LOREY (*Allg. Forst u. Jagd Ztg., 76 (1900), Sup., pp. 1–98*).—Briefly reviews the forest literature relating to forest botany, zoology, etc.

DISEASES OF PLANTS.

The fungus infestation of agricultural soils in the United States, E. F. SMITH (*Proc. Amer. Assoc. Adv. Sci., 48 (1889), p. 303*).—The results of the author's studies on parasitic Fusariums, as shown by his completed experiments on soil infections with the watermelon fungus, are given. It is shown that related species of Fusariums prove equally destructive to other plants, such as cabbage, tomato, sweet potato, etc. It is also shown that these fungi live in the soil over winter and attack the plant from the earth. A soil once infected with any of these

resistant fungi becomes worthless for growing agricultural plants subject to it for a long series of years. On this account the greatest care should be taken to avoid the spread of these parasites to land which is now free from them.

The black rot of cabbage and similar plants in Europe, H. A. HARDING (*Centbl. Bakt. u. Par.*, 2. *Abt.*, 6 (1900), *No. 10, pp. 305–313, pls. 2, figs. 2*).—An account is given of the author's investigations in Europe of the black rot of cabbage and similar plants, which has been attributed to a bacterial parasite, *Pseudomonas campestris*. He reports having observed the disease in the open field in about a dozen localities in northwestern Europe. The organism was isolated, cultivated, and comparisons made with the organism described by Smith and Russell in this country.

Infection experiments were conducted in pots in which the organisms isolated from diseased cabbages in New York and in Wisconsin were compared with the organism isolated from Swiss crucifers. At the termination of the experiments the organisms were compared, and no differences were noted between the bacteria derived from the different sources.

Observations on a disease of plum trees, DUKE OF BEDFORD and S. U. PICKERING (*Woburn Expt. Fruit Farm Rpt. 1900, pp. 218–227*).—In a previous report (E. S. R., 9, p. 761) a description is given of a fungus disease which was proving fatal to standard plum trees at Harpenden. The disease at that time was attributed to *Nectria ditissima*, but subsequent investigations showed that this fungus was not the primary cause of the disease. In 1898 41 per cent of the whole plantation had been killed by the disease. The fungus seems to spread very rapidly. Trees which failed to show any signs of the disease when examined in the winter, were badly attacked before the following midsummer. From the tables given, it appears that old trees, 9 years or more old, were the greatest sufferers. Subsequent examinations in another locality of a disease which was believed to be the same showed the trouble was due to *Eutypella prunastri*. Successful inoculation experiments were conducted, which produced symptoms very similar to those exhibited by the trees at Woburn Farm. While not affirming that the diseases are identical, it is believed that the trees in each locality were suffering from the same cause. A curious feature in connection with this disease was the sudden disappearance of the disease in 1899. This sudden disappearance is explained by the possibility that the fungus fruits only under special climatic conditions, which were absent at this time.

Fungus diseases of citrus trees in Australia and their treatment, D. MCALPINE (*Melbourne: Department of Agriculture, 1899, pp. 132, pls. 31*).—General descriptions and suggested methods of treatment are given of the principal diseases of citrus trees occurring

in Australia. In all, 82 species of fungi have been identified, 51 of which are new to science. Of these, 38 are said to be parasitic on different parts of citrus trees or fruits.

False melanose, anthracnose, sooty mold, black scurf, scabbing, wither tip, bark blotch, collar rot, and root rot of lemon are described at considerable length. The false melanose, which attacks not only the fruit but leaves and young shoots, is said to be due to *Cladosporium brunneo-atrum*, n. sp. The anthracnose, which is attributed to *Phoma citricarpa*, n. sp., is said to be quite common on fruits sold in the vicinity of Melbourne and Sydney. It causes considerable damage to the orange and lemon crops, spreading rapidly from fruit to fruit and from tree to tree. It is not to be confused with the leaf spot occurring in Florida on sweet and wild orange trees, which is caused by attacks of *Colletotrichum adustum*. The sooty mold of orange and lemon, caused by *Capnodium citricolum*, is described at considerable length, and the relation between this disease and certain insects pointed out. The black scurf of citrus fruits is caused by *Coniothecium scabrum*, n. sp. The symptoms of this disease are said to be very characteristic. It first begins as small black depressions, causing the skin over a considerable area to become a yellowish green. It gradually spreads and forms large sooty, black patches, the epidermis cracking into minute irregular areas. In addition to making the fruit very unsightly, it renders it extremely liable to saprophytic fungi, causing decay. The scabbing of fruits and leaves is described, in which 11 different species of fungi are concerned, 6 of which are found upon the leaf. The wither tip of orange and lemon is attributed to *Phoma omnivora*, n. sp. It resembles to some extent the disease known in Florida as die-back, and the striking differences between the two are pointed out.

The lemon bark blotch, due to *Ascochyta corticola*, n. sp., is described. In this disease the trees from the collar upward for 6 or 8 in. become shriveled and studded with small brownish, thickly clustered bodies. The disease finally works all around the tree and the tree dies.

The collar rot, caused by *Fusarium limonis*, and the root rot of lemon, due to *Phoma omnivora*, are described. In part 2 technical descriptions of all the fungi found upon citrus trees are given.

The Graphiola disease of palm leaves, K. von Tubeuf (*Gartenflora, 49 (1900), No. 6, pp. 148–150, fig. 1*).—The author describes a disease of palm leaves which is characterized by the appearance of small black areas on both sides of the leaves. These occurring very abundantly give a blackened and unsightly appearance to the leaves and ultimately cause their destruction. The disease seems to be widely distributed and is caused by *Graphiola phœnicis*, which occurs principally on the leaves of *Chamærops humilis*, but has not been previously

observed on the leaves of the date palm. Diseased leaves should be cut off and burned in order to prevent the spread of the disease. Sound plants may be sprayed with Bordeaux mixture, or the leaves may be washed with soapsuds or a weak solution of lysol to prevent the germination of spores.

A disease of conifers, G. MASSEE (*Gard. Chron., 3. ser., 27 (1900), No. 686, p. 101, fig. 1*).—A report is given of attacks of *Sclerotinia fuckeliana* on Sequoias and other coniferous trees. When first observed, the portions attacked seemed to be covered with a dense outgrowth of gray mold. After the twigs were dead, numerous small black sclerotia, about the size of a pin's head, were found embedded in the bark and also in the tissues of the diseased and fallen leaves. Artificial infection of conidia have shown that Scotch fir and, perhaps, most conifers are susceptible to this disease. Other groups of plants, such as cherries, etc., have been artificially inoculated, but, on the whole, coniferous seedlings appear to suffer the most. When the disease appears, it spreads very rapidly, especially during damp, cloudy weather, and spraying with dilute Bordeaux mixture or what the author calls "violet mixture" should be resorted to as a check to prevent further spread. Experience has shown that plants once attacked invariably die; hence all diseased plants should be promptly removed and burned. The "violet mixture" recommended is said to adhere to the foliage better than the Bordeaux mixture and does not leave a white deposit on the plant sprayed. It is composed of copper sulphate 2 lbs., copper carbonate 3 lbs. permanganate of potash 3 oz., and water 18 gal.

New species of fungi, FLORA W. PATTERSON (*Bul. Torrey Bot. Club, 27 (1900), No. 5, pp. 282–286*).—Descriptions are given of 17 new species of fungi, many of which are parasitic. *Stemphylium butryi* is described as growing in butter, the surface of which gradually becomes a bluish black color.

New species of fungi, J. B. ELLIS and B. M. EVERHART (*Bul. Torrey Bot. Club, 27 (1900), No. 11, pp. 571–578*).—Descriptions are given of 27 new species of fungi, many of which are parasitic. The specimens are from various American localities.

The rusts of cereals, E. MARCHAL (*Jour. Soc. Agr. Brabant-Hainaut, 1900, pp. 286–288*).

The cereal rusts of Belgium, H. VANDERYST (*Rev. Gén. Agron. [Louvain], 9 (1900), No. 8, pp. 359–368*).—The author reports having observed 189 species, representing 17 genera, of Uredinæ in Belgium during the season of 1898. Brief notes are given on their distribution throughout the country.

Depreciation of the yields of cereals due to rusts, A. GRÉGOIRE (*Jour. Soc. Agr. Brabant-Hainaut, 1900, p. 173*).

The fungus diseases of the potato and their treatment, H. POTEL (*Bol. Inst. Agron. São Paulo, 10 (1899), No. 11–12, pp. 795–799*).

Fungus diseases of sweet potatoes, H. POTEL (*Bol. Agr São Paulo, 1. ser. 1900, No. 1, pp. 45–48*).

The potato disease, its history and prevention, LAVERGNE (*Santiago, 1900, pp. 10*).

A disease of potatoes and melons in Santiago and Coquimbo, LAVERGNE (*Santiago, 1900, pp. 12*).

A sorghum disease in Usambara, STUHLMANN (*Tropenpflanzer, 4* (*1900*), *No. 11, pp. 561, 562*).—A brief note is given on a disease of sorghum in Africa. The cause is not definitely known, and some varieties seem more subject to it than others.

Fungus diseases of the sugar beet (*Beet Sugar Gaz., 2* (*1900*), *No. 9, pp. 5–8, figs. 3*).—Notes are given on root rot due to Rhizoctonia and on the leaf spot disease caused by *Cercospora beticola.*

The practical workings of seed treatment for prevention of diseases of sugar beets, B. FRANK (*Bl. Zuckerrübenbau, 6* (*1899*), *No. 5, pp. 65–68*).

Notes on some fungus parasites of fruit trees, L. DE NOBELE (*Bul. Arbor. et Flor., 1900, pp. 147–150*).

Combating Fusicladium on fruit trees (*Deut. Landw. Presse, 27* (*1900*), *No. 91, pp. 1106, 1107, figs. 3*).—The value of Bordeaux mixture as a means for the prevention of scab of apples and pears is shown. Three applications are recommended and the leaves in the autumn should be collected and burned.

Fungus pests of citrus trees (*Agr. Jour. Cape Good Hope, 17* (*1900*), *No. 7, pp. 421–424*).—Brief popular descriptions are given of a number of principal fungus pests on citrus trees, which have been observed in Australia. The diseases described are false melanose, withered tip, anthracnose, sooty mold, black scurf, scab, bark blotch, collar rot, and root rot. Suggestions are given for the prevention of these different diseases, and among the fungicides recommended are Bordeaux mixture, a dilute solution of copper sulphate, ammoniacal copper carbonate, carbolic acid, sulphur, etc.

Some fungi of the cacao tree, J. H. HART (*West Indian Bul., 1* (*1900*), *No. 4, pp. 422–427, pl. 1*).—Notes are given of attacks of *Phytopthora omnivora, Nectria bainii,* and an undescribed species of Nectria, all of which proved considerably injurious to the production of pods of cacao. The Phytopthora is said to diminish the weight of the pods fully 25 per cent. The beans are reduced at the same time and there is quite a depreciation in their quality.

Concerning the bacterial diseases of strawberries, P. VOGLINO (*Ann. Accad. Agr. Torino, 42* (*1899*).

Fungus diseases of the grape (*Oklahoma Sta. Rpt. 1900, pp. 104–107, figs. 3*).—Brief descriptions are given of anthracnose, black rot, brown rot or downy mildew, and shelling or rattles of grapes, with suggestions for their prevention.

Rust, leaf spot, and anthracnose of grapes, L. BALDRATI (*Italia Agr., 1900, No. 6, pp. 4*).

Observations on grape anthracnose, J. CAPUS (*Observations sur l'anthracnose maculée. Bordeaux, 1900, pp. 15*).

Variations in the maturing of Plowrightia morbosa spores, W. A. RILEY (*Bul. Torrey Bot. Club, 27* (*1900*), *No. 5, pp. 286, 287*).—While studying the black knot fungus considerable variation was noticed in the time of maturing the ascospores. January has been given as the time for their maturation in Massachusetts, but in New York the first appearance was noted on March 7, and only by the middle of April were they fairly abundant. Examinations made as late as May 9 showed 75 per cent of the spores immature.

Practical directions for combating Peronospora, A. BIZZOZERO (*Istruzioni practiche per combattere la peronospora e la crittogama. Parma, 1900, pp. 29*).

On the use of copper sulphate as a remedy for Peronospora, L. SOSTEGNI (*Extr. Giorn. Viticol. e Enologia, 7* (*1899*), *pp. 15*).

The occurrence of the California vine disease in Avellino, C. CASALI and T. FERRARIS (*Extr. Giorn. Viticol. e Enologia, 8* (*1900*), *pp. 10, pls. 2*).

Liver of sulphur for combating oidium, G. BATTANCHON (*Vigne Amer. et Viticult. Europe, 24* (*1900*), *No. 7, pp. 199–201*).—A formula of potassium sulphid 500 gm., black soap 500 gm., and water 100 liters is given. The efficiency of the liver of sulphur is said to be increased by adding the soap.

A new disease of the leaves of Aucuba japonica, C. MASSALONGO (*Bul. Soc. Bot. Ital., 1900, pp. 166, 167*).

Notes on outgrowths on the green parts of Hibiscus vitifolius, DALE (*Proc. Camb. Phil. Soc., 10 (1900), No. 4, pp. 192–209, pls. 3*).

A disease of birch trees, R. PAULSON (*Nature, 62 (1900), No. 1616, p. 599*).—A brief note on the occurrence of a destructive disease of birch trees in parts of England. The cause of the disease is thought to be *Melanconis stilbostoma*, since that fungus is found abundant on both living and dead trees.

A contribution to the knowledge of an oak root parasite, R. HARTIG (*Centbl. Gesam. Forstw. Wien, 26 (1900), No. 6, pp. 243–250, figs. 10*).—Notes are given on the life history of *Rosellinia quercina*, a destructive parasite of oak roots. The most serious injury is to seedlings, although the author reports the perithecia of the fungus on old plants. The spores germinate readily in water after 24 hours, and retain their vitality for at least a year. The mycelium attacks the cellulose of the root, dissolving it and also uses up the starch in the roots.

Preliminary note on some witches' brooms, R. A. ROBERTSON (*Trans. and Proc. Bot. Soc. Edinburgh, 21 (1900), pt. 4, pp. 313–318, figs. 2*).—Notes are given of witches' brooms observed on the larch and *Picea nobilis*. These formations are well known on some coniferous trees, but on the species mentioned they are comparatively rare. Other witches' brooms are reported as occurring on ash (*Fraxinus excelsior*), and upon *Crataegus oxyacantha*. The author states he has been unable to find any record of such outgrowths occurring on either of these species.

The adhesiveness of potassium permanganate as a fungicide, G. CHAPPAZ (*Prog. Agr. et Vit. (Éd. L'Est), 21 (1900), No. 47, p. 625*).—As a result of a single application in June, traces of the permanganate were found upon the grape leaves in autumn.

A disinfecting machine for cereals, F. FALKE (*Landw. Wchnschr. Sachsen, 2 (1900), Nos. 41, pp. 365–367; 42, pp. 374, 375*).—A description is given of a machine designed for the rapid treatment of cereals with formalin or formalin and ammonia for smut prevention. Comparative figures are also given in which the efficiency of the treatment is shown as well as the effect upon the germination of the seed.

A review of the literature relating to plant protection during 1899, M. HOLLRUNG (*Jahresbericht über die Neuerungen und Leistungen auf dem Gebiete des Pflanzenschutzes. Berlin, 1900, pp. 303*).—Brief reviews are given of the general literature relating to fungus diseases and insect enemies of plants and the means taken for combating them. In the second part the literature pertaining to these injurious agents is grouped according to the host plants, the principal groups being: Injuries to plants without reference to the hosts; injuries to cereals, to fodder grasses, root crops, garden crops, forage crops other than grasses, large and small fruits, grapes, tropical plants, forest trees, and ornamentals. The means for combating these diseases are divided into natural and artificial methods, the latter referring to chemical and mechanical agencies, while the former refers to parasites, etc. An annotated list of nearly a hundred pages of titles of publications in addition to those abstracted at greater length completes the volume and serves to give some idea of the extent of the literature upon the subject.

ENTOMOLOGY.

Apiary experiments, C. P. GILLETTE (*Colorado Sta. Bul. 54, pp. 28, pls. 6*).—The general problem with which this bulletin is concerned is the question to what extent and in what form wax can be best furnished to bees for their use in building comb. As is well known, it is generally believed that bees use wax from artificial foun-

dations to extend the cell walls and the comb midrib. This belief was shown to be well founded by a simple experiment, during which sheets of thin foundation rendered black by the addition of lampblack were employed. It was found that the wax used both for the extension of the midrib and the formation of cell walls contained lampblack.

The author measured a number of artificial foundations of comb midrib built upon such foundations and a natural midrib of comb. The evidence confirms that obtained by weighing the same structures, that heavy foundations are somewhat thinned by the bees in constructing comb upon them, but that these foundations are not thinned in any case to the lightness of natural comb.

To determine whether the use of artificial foundations results in thicker cell walls in the comb, experiments were made with several kinds of foundation, measurements being made with the camera lucida and a compound microscope. The cell wall in natural worker comb varied from 0.045 to 0.07 mm., with an average of 0.06 mm. None of the artificial foundations gave as thin cell walls except, perhaps, the thin and extra thin super foundations. The author concludes from this experiment that it is a mistake to make deep cells in artificial foundation unless their walls can be rendered as thin as those of the natural cell walls. The only cell walls which were brought to the thinness of the natural comb were those which were built on foundations with a light base and with little wax in the cell walls. To study the effect of foundations upon the resulting comb, pieces of natural comb and comb on different kinds of foundation were cut into blocks of known area and weight, the cell walls were then removed from the midribs, and the two portions weighed separately. The weights of the midribs and cell walls of natural comb were compared with corresponding parts of comb from artificial foundations. The evidence leads to the conclusion that heavy foundations result in combs which are heavier than the natural combs, and that the increased weight is due both to thicker midribs and thicker cell walls, but more especially to the latter. The evidence shows also that if the cell walls are high they are not often thinned by the bees in constructing the comb.

Studies of the extent to which the use of foundation lessens the secretion of wax by bees were made by a similar series of weight determinations. The evidence furnished by the weights of 49 samples of comb indicates that the wax secretion by bees is not any more influenced by furnishing them with a heavy foundation than by the use of a light foundation.

With regard to the methods of using foundation in sections, the author found that by using a long piece of foundation gradually tapering to a point, with a broad base attached to the upper edge of the section, the bees showed a tendency to form worker comb throughout.

The best results, however, were obtained by using a long narrow piece placed across the top of the section, or a rectangular starter extending about halfway down the section.

The use of wooden or tin separators between the rows of sections is strongly advocated by the author, since by their use the sections are rendered much more regular.

By determinations of the weight of different samples of comb honey it was found that the weight of the wax in thick combs is proportionately less than in thin combs, the proportion varying from 1:19 to 1:28.

The author tried a number of substitutes for pollen, the substances being laid upon flat boards in the vicinity of the apiary. A small pile of each kind of meal was put upon the different boards, and notes were taken upon the apparent frequency with which the different kinds were visited. The order of preference appeared to be as follows: Ground whole kernels of oats, corn, wheat, fine wheat bran, cleaner dust, cotton-seed meal, wheat bran, pea meal, wheat flour, rye flour, bean meal, and barley meal.

Bee poison and bee stings, J. LANGER (*Sitzber Deut. Naturw. Med. Ver. Böhmen, n. ser., 19 (1899), pp. 291–310*). Bee poison has an acid reaction, but its toxic action is not due to formic acid. It is free from bacteria and has the effect of slightly checking the growth of micro-organisms. The author made observations on the sensitiveness of different persons to bee poison. Of the individuals upon whom observations were made, 11 were not sensitive to the poison, and 153 were sensitive when they first began the business of bee culture. Brief notes are given on the various remedies which are popularly employed for the treatment of bee stings. The author recommends that in the case of persons who are oversensitive to the action of this substance, chemical antidotes should be applied at the point of the sting by means of a hypodermic syringe.

On the metamorphosis of the young form of Filaria bancrofti in the body of Culex ciliaris, the house mosquito of Australia, T. L. BANCROFT (*Jour. and Proc. Roy. Soc. New South Wales, 33 (1899), pp. 48–62, figs. 8*).—The author gives a brief critical account of the literature relating to this subject. It was found by experiments that the Filariæ do not develop so rapidly in the body of mosquitoes as had hitherto been suspected. According to the author's experiments, the time required for this development is 17 or 18 days. The Filaria is first taken into the alimentary tract along with the blood sucked from the host of the mosquito and later penetrates into the thorax. All Filariæ which are for any reason unable to make their way to the thorax of the mosquito ultimately die or, at least, fail to produce young Filariæ. The juices of the alimentary tract seem to have an injurious effect upon them and they are in some cases killed outright and digested by these fluids. In dissecting mosquitoes infested with

Filariæ in water, it was found that the Filariæ died after remaining 3 or 4 hours in water. It is therefore believed by the author that infection of man by Filariæ can not take place from drinking water. An account is given of various details in the life history of the *F. bancrofti*.

Natural enemies and insecticide treatments for the larvæ of Pieris brassicæ, G. DEL GUERCIO (*Atti. R. Accad. Econ. Agr. Georg. Firenze, 4. ser., 23 (1900), No. 2, pp. 242-254, figs. 3*).—Hand picking of the larvæ and eggs of this species is more practicable than in the case of *P. rapæ* and *P. napi* for the reason that in the latter 2 species the larvæ are found on the under side of the leaves and the eggs are laid in small clusters or isolated.

The insecticides used against *P. brassicæ* included superphosphate of lime, emulsions of potash and soda soaps, emulsions of petroleum, benzine, and bisulphid of carbon, emulsions of heavy oil of tar and of creolin, carbolized extract of tobacco, and a solution of alkaline tar. Applications of superphosphate of lime at the rate of 500 kg. per hectare had no noticeable effect upon caterpillars. Emulsions of potash soap, in which the soap constituted from 1½ to 2½ per cent of the emulsion, were quite effective remedies. Soda soaps in from 2½ to 3½ per cent solution of water gave good results. Emulsions of oil of tar, creolin, and similar substances when used as insecticides against the larvæ of the cabbage butterfly left a disagreeable odor upon the cabbage plants and are therefore not recommended.

The author describes and gives brief notes upon a considerable number of insect parasites and enemies of the cabbage butterfly. The percentage of caterpillars parasitized by the more important species are tabulated and the importance of insect parasitism of the cabbage butterfly is discussed in connection with this table.

Moth borer in sugar cane (Diatræa saccharalis), H. MAXWELL-LEFROY (*West Indian Bul., 1 (1900), No. 4, pp. 327-353, figs. 10*).—The author reviews the literature relating to this subject. Detailed descriptions are given of the insect in all its stages. The eggs are laid on the surface of the leaf in clusters numbering about 19. The author gives notes on 2 insect parasites, *Trichogramma pretiosa* and *Cordyceps barberi*. As soon as the young leaves of the sugar cane are up, the moth borer begins its attack which results in producing "dead hearts" early in the year. The attacks of the moth borer render subsequent infestation by the rind fungus (*Trichosphæria sacchari*) more easy. All varieties of cane are attacked by the moth borer, which has been found also upon a considerable number of other plants. A detailed discussion is given of the remedies which have been recommended by various committees of planters and by agricultural societies. The more important remedies may be briefly stated as follows: Careful selection of canes for planting, pruning of dried and decayed canes, destruction of diseased canes and the stumps of canes, and the use of

lantern traps for catching the moths. The author recommends also the collection of eggs which may be recognized on leaves. Care should be exercised, however, to leave all parasitized eggs so that the parasites may hatch and assist in reducing the numbers of the moth borer. An extensive bibliography of the subject is added to the article.

A report on methods of combating the grape Cochylis by winter treatment, J. LABORDE (*Bul. Min. Agr.* [*France*], *19* (*1900*), *No. 3, pp. 373–392*).—The author states that the name Cochylis has been applied to two insects, *Tinea ambiguella* and *Eudemis botrana*. The insects were studied in the laboratory in all of their stages. Several parasites were reared from each of these insects. Chrysalids maintained for 24 hours at a temperature of -10 to 12° C. were unharmed by the exposure. Chrysalids of Eudemis plunged for one minute in water at a temperature of 40° died to the extent of 20 per cent. A similar exposure in water at 50° C. killed all the chrysalids.

Among the chief remedies applied by the author mention should be made of scraping the bark, plunging the grape stocks in hot water, and painting with various mixtures. It is stated that painting with a mixture composed of lime, heavy oil, and bisulphid of carbon is very effective in destroying the insects and may be used without causing injury to the grape vines.

The grape-cane gall maker and its enemies, F. M. WEBSTER (*Ohio Sta. Bul. 116, pp. 195–198, pl. 1*).—The author's observations on this insect are confined to vineyards near Gypsum, Ohio. The galls produced by the beetle are always provided with an opening which does not heal until after the escape of the adult insects. The author believes that the complete life cycle is passed inside the galls. Fallen leaves collected near a vineyard on May 6, 1898, were placed in the insectary and adult beetles began to emerge from the mass of leaves on May 23. In the vineyard, near where the leaves were collected, numerous galls containing larvæ were found on June 24. All stages of the insect were found in these galls on August 11, and at this time some of the adults were already emerging. The life history of the insect may therefore be described as follows: The eggs, deposited in May or June, hatch into larvæ which live in the galls formed on the canes and finally transform into adults which leave the vines and pass the winter under fallen leaves or matted grass.

Catolaccus tylodermæ is mentioned as an important parasite of this insect. The beetle seems to prefer the Concord variety, and it is recommended that this variety be planted in the central portion of the vineyard. The author suggests as a preventive measure the collection and destruction of fallen leaves and other rubbish in the vicinity of vineyards.

Fumigation with hydrocyanic-acid gas, A. D. HALL (*Bd. Agr.* [*London*], *Rpt. Agr. Education and Research, 1899–1900, pp. 71–73*).—Experiments were conducted for the purpose of determining the

value of hydrocyanic-acid gas as a remedy for the black currant bud mite. Two thousand infested currant bushes were tied in bundles, placed in a heap on the ground, and the whole covered with waterproof cloth. In a small vessel in the center of the heap of bushes the author placed 100 cc. of water, an equal quantity of strong sulphuric acid and 36 gm. of 98 per cent cyanid of potash. After 1 hour the cloth was removed and a microscopical examination failed to show any living mites or eggs. The bushes were subsequently planted out and kept under observation. At present indications point to a complete destruction of the mite. Successful results with the same treatment were also obtained with large bushes planted in the field. The author believes the results of his experiments should encourage fruit growers to make a thorough trial of fumigation with hydrocyanic-acid gas for such insect pests as do not yield to ordinary treatment. Brief suggestions are given concerning the application of this method to greenhouses and against the mealy bug and other insect pests.

An historical account of apiculture in connection with its fate in Siberia and Transbaikal, A. Kuznetzov (*Istoricheskii ocherk pchelovodstva v soyazi s sudboyu ego v Sibiri i Zabaikalye. Chita: 1899, pp. 13; rev. in Selsk. Khoz. i Lyesov, 196 (1900), Jan., pp. 191, 192*).—In Siberia apiculture has undergone its greatest development in Altai. Detailed accounts are given by the author of the conditions which are favorable to the rearing of bees and upon the connection of this industry with fruit raising.

The migration of insects, K. Sajo (*Prometheus, 10 (1900), Nos. 515, pp. 737–741; 516, pp. 758–761, figs. 9; 517, pp. 770–772, fig. 1; 518, pp. 785–789; 519, pp. 802–806; 520, pp. 817–821*).—The author presents a general discussion of the means of distribution of insects with special reference to their larger migratory movements. The climatic and other conditions which may in any way influence such movements of insects are also considered. Among the species to which special attention is given mention may be made of *Blissus leucopterus*, *B. doriæ*, *Baris scolopacea*, *Phylloxera vastatrix*, *Otiorrhynchus ligustici*, *Porthetria dispar*, *Cheimatobia brumata*, *Vanessa cardui*, species of Pieris, and *Pachytylus migratorius*.

Experimental proof of the mosquito malaria theory, P. Manson (*British Med. Jour., 1900, No. 2074, pp. 949–951, figs. 2*).—An experiment was tried in importing mosquitoes from Italy which had sucked the blood of malarial patients. These mosquitoes were allowed to puncture the skin of the hand with the result that a typical case of malarial fever developed. A wooden hut, constructed in England, was shipped to Italy and placed in a locality which was ascertained to be intensely malarial. Five persons entered on a residence in this hut early in July. On September 21, when the last report was made, no case of malaria had developed among the experimenters, although the neighbors were all suffering from malaria or had had attacks. For the control of malaria the author recommends the drainage of the breeding pools of Anopheles and protection from mosquito bites.

The relationship of drinking water, water logging, and the distribution of Anopheles mosquitoes, respectively, to the prevalence of malaria north of Calcutta, L. Rogers (*Proc. Asiatic Soc. Bengal, 7 (1900), July, pp. 90–98*).—The author, while admitting the agency of mosquitoes in transmitting malaria, believes that a total destruction of mosquitoes, even in a small area, is practically impossible.

The kissing bug, P. J. Parrott (*Industrialist, 27 (1900), No. 1, pp. 1–4, figs. 3*).—Notes on the more common species of bugs in Kansas which have received this pop-

ular name, among which the following may be mentioned: *Melanolestes picipes*, *Conorhinus sanguisuga*, and *Opsicœtus personatus*.

Observations on itch mites, J. BRANDL and F. GMEINER (*Wchnschr. Tierheilk. u. Viehzucht, 44 (1900), No. 15, pp. 137–143*).—An account of the literature which deals with the effects of various insecticide substances upon species of mites affecting domestic animals.

The Hottentot bug (Eurygaster maurus), T. ZOLOTILOV (*Selsk Khoz. i Lyesov, 196 (1900), Feb., pp. 441–450*).—This insect is reported as injurious to grain, both when young and when filling. Rye, wheat, corn, and sunflowers are attacked; also oats to a slight extent. Barley and millet are not injured by this species. As remedial measures the author recommends burning the stubble and planting barley and millet around the fields of wheat and rye.—P. FIREMAN.

Men and horses partially incapacitated by the bites of Simulium in a Hampshire wood, J. CANTLIE (*British Med. Jour., 1900, No. 2052, p. 1053*).—Brief notes are given of an attack of a species of Simulium upon men and horses. Considerable local pain and œdema were produced by the bite.

Miscellaneous insects, H. E. SUMMERS (*Iowa Sta. Bul. 49, pp. 9, figs. 7*).—The Buffalo tree hopper (*Ceresa bubalus*) is believed to have been the most important apple insect in Iowa for the past two years. It attacks also the cherry, and has been occasionally observed laying its eggs in the pear, plum, peach, cottonwood, maple, willow, and elm.

The snowy tree cricket (*Oecanthus niveus*) is considered the most serious insect enemy of the raspberry in the State. The box-elder plant bug (*Leptocoris trivittatus*) sometimes causes injury to the fruit of the peach, plum, and apple. The approved remedies are recommended for the destruction of each of these insects.

Some insects injurious to fruit, B. F. MACCARTNEY (*Pennsylvania Dept. Agr. Rpt. 1899, pt. 1, pp. 88–122, figs. 44*).—This report contains popular notes on a large number of insects affecting apple, pear, plum, peach, cherry, grape, raspberry, blackberry, currants, gooseberries, strawberries, shade trees, and clover.

Report on a disease of plum trees in the neighborhood of Villeneuve-sur-Lot, PRILLIEUX and DELACROIX (*Bul. Min. Agr. [France], 19 (1900), No 1, pp. 67–75*).—The authors report serious depredations by *Scolytus rugulosus* upon plum trees. Brief notes are given upon the life history and habits of this beetle. It is believed that the beetles may be instrumental in carrying the spores of certain fungi which assist in the weakening or destruction of the trees. It is recommended that very badly infested trees should be destroyed with the insects and that plum orchards should be well cared for in order to keep the trees in vigorous condition and thus render them more resistant to the attacks of the bark beetle.

The San José scale, J. M. SOUTHWICK (*Rhode Island State Bd. Agr. Bul. 7, pp. 6*).—Brief biological and economic notes on this insect.

Treatment of the woolly aphis, H. DAUTHENAY (*Rev. Hort., 72 (1900), No 19, pp. 557, 558*).—Brief notes on the results of experiments with two insecticides made as follows: (1) Water, 10 liters; acetic acid, 1,000 gm.; salicylic acid, 2 gm.; red oxid of mercury, 1 gm.; and fuchsine, 25 gm.; (2) creolin, 35 gm.; black soap, 35 gm.; and water, 1 liter.

Plant lice, E. HENNING (*Landtmannen, 11 (1900), No. 31, pp. 490–492, fig 1*).—Biological and economic notes on phylloxera, woolly aphis, *Tetraneura ulmi*, and *Aphis persicæ niger*.

Kerosene emulsion and lysol as remedies for plant lice on fruit trees (*Landtmannen, 11 (1900), No. 26, pp. 420–422, figs. 2*).—Kerosene emulsion proved to be especially effective as an insecticide against these insects.

Insects affecting the grape, E. E. BOGUE (*Oklahoma Sta. Rpt. 1900, pp. 108–115, figs. 4*).—Notes on the habits, life history, and remedies for the stem borer, gray

skeletonizer, spotted vine chafer, brown-backed skeletonizer, grapevine leaf folder, rose chafer, and grape-berry moth. Formulas are given for preparing Bordeaux mixture, ammoniacal solution of copper carbonate, potassium sulphid, Paris green, kerosene emulsion, hellebore, and pyrethrum.

Some results of experiments in spraying at the Central Experiment Farm in 1899, W. T MACOUN (*Ontario Fruit Growers' Assoc. Rpt. 1899, pp. 100–109*).—During experiments in spraying trees with whitewash to determine the effect of this substance in retarding bug development in early spring, it was noticed that the oyster-shell bark louse, which had resisted all other insecticide applications, was entirely destroyed. The whitewash was made of 6 gal. of skim milk, 24 gal. of water, and 60 lbs. of lime. The author believes that this remedy may prove effective in combating the San Jose scale. Brief notes are given on the means of distribution of the codling moth.

The advantages of fumigation, J. W. JEFFREY (*California Cultivator, 15 (1900), No. 7, pp. 97, 103*).—A popular discussion of the method of fumigation and of practical advantages derived from its application.

A note on the use of bisulphid of carbon on a large scale, V. VERMOREL (*Note sur l'emploi du sulfure de carbone en grande culture. Villefranche (Rhône) and Montpellier: Progres Agricole et Viticole [1900], pp. 12*).—This pamphlet contains a brief account of the value of bisulphid of carbon in treating grapevines for phylloxera and in similar applications of this substance. The influence of bisulphid of carbon upon the soil is also discussed.

Insecticide methods, H. E. SUMMERS (*Iowa Sta. Bul. 50, pp. 13–23*).—The author presents a general account of mechanical and chemical methods for combating injurious insects. Among the former are included barriers, trunk washes, worming, hopperdozers, burning, and hand picking. Among the chemical methods reference is made to Paris green, London purple, arsenite of lime, arsenate of lead, resin lime mixture, kerosene, kerosene emulsion, tobacco infusion, whale-oil soap, pyrethrum, hydrocyanic-acid gas, carbon bisulphid, and Bordeaux mixture.

Russian literature in entomology since 1896, N. KULAGIN (*Opuit o literaturye po nasyekomuim za 1896. Moscow: Ministry of Agriculture and Imperial Domains, 1900, pp. 61; abs. in Selsk. Khoz. i Lyesov, 196 (1900), March, pp. 719, 720*).

FOODS—ANIMAL PRODUCTION.

Cellulose and pentosans in feeding stuffs, I. SHIROKIKH (*Selsk. Khoz. i Lyesov., 195 (1899), Oct., pp. 121–144*).—The great diversity of views regarding the nutritive value of cellulose is, in the opinion of the author, largely due to the fact that the crude fiber has been considered, rather than the cellulose and the pentosans separately. He reports an investigation in which these were considered separately.

To study the digestion of cellulose, experiments were made with sheep and rabbits. The sheep were fed from 4 to 7 days and then killed 6 to 12 hours after the last meal. The digestive organs, with their contents, were then detached and cut into 13 parts. The contents of each part were weighed separately, then dried and analyzed. When hay and coarse fodders were fed, it was found that while the food is in the paunch a larger or smaller part of the cellulose (up to one-third of the total quantity) dissolves, and in the third stomach a smaller percentage of it is found than in the food as eaten. As the

food passes from the third to the fourth stomach (abomasum), and especially from the latter into the small intestines, the percentage of cellulose falls very low, which is connected chiefly with the admixture of the intestinal juice but also probably with the solution of cellulose. From the middle of the small intestines the percentage of cellulose again increases, this increase continuing to the excretion of the feces, except in the blind intestine, where the increase is prevented by the more energetic decomposition of the cellulose, which exceeds the absorption of all the dissolved parts of the food.

With tender or green food the results were somewhat different. Thus, in the case of one sheep fed green oats the percentage of cellulose in the paunch remained unchanged, and, what is especially important, even on passing into the third stomach the percentage of cellulose was not lowered but increased slightly. The amount of the other components of the fodder, except the starch, also remained practically unchanged. In connection with this circumstance the following is noted: When hay (clover and timothy) was fed, judging from the feces 72 hours were required for the passage of the fodder through the alimentary canal, and it is assumed that the fodder remained in the paunch for 48 to 54 hours, while the remaining 24 hours, or possibly only 18 hours, were required for the passage of the small intestines and the blind intestine. On the other hand, when grass was fed, the fodder remained in the alimentary canal not longer than 36 hours, of which only 12 to 18 hours were required in the paunch. As to the changes of the cellulose content in the parts of the alimentary canal beyond the third stomach, no difference is observed when feeding with hay and with grass.

In herbivora, other than ruminants, the changes of the cellulose content are different. Experiments were made with rabbits, of which 3 were fed with hay, 1 with green grass, 2 with peas, and 3 with hay. The latter were young rabbits. The experiments showed concordantly that here the main part of the cellulose is decomposed in the blind intestine.

In the foregoing experiments only the comparative amounts of cellulose in the various parts of the alimentary canal were considered. The absolute amounts of cellulose digested were studied in an experiment with a horse and a sheep. The experiment with the sheep lasted 6 days, 965 gm. of meadow hay per day being consumed. The horse received an average of 18 lbs. of hay per day. The digestibility was as follows:

Fiber, cellulose, and pentosans digested by a horse and sheep.

	Experiment with a sheep.			Experiment with a horse.		
	In the hay consumed.	In the feces excreted.	Coefficient of digestibility.	In the hay consumed.	In the feces excreted.	Coefficient of digestibility.
	Gm.	*Gm.*	*Per ct.*	*Gm.*	*Gm.*	*Per ct.*
Organic matter	795	281	64	6,263	3,042	51
Pentosans	171	65	62.6	1,005	670	33
Crude fiber	288	105	65	1,938.2	1,306.5	33
Cellulose	260	74	71.5	1,760	862	51

In the case of the sheep the digestibility of the fiber corresponds to the mean value given by Wolff for sheep. The digestibility of the pure cellulose is greater than that of the fiber. The digestibility of the pentosans, on the contrary, is not only lower than that of cellulose and fiber, but is somewhat lower than that of the total organic matter. This is still more marked with the horse.

Considering the ratio between the cellulose and the pentosans as found in the experiment with sheep, it is shown that the ratio in the hay is first altered in the third stomach. This may be due to the fact that cellulose is more easily decomposed by micro-organisms than pentosans, and hence is destroyed in the paunch to a greater extent. In the small intestines, where the intestinal juice is supposed to take part in dissolving the cellulose and the pentosans, the ratio remains unchanged; but in the blind intestine, where the cellulose is again subjected to strong decomposition by bacteria, the ratio of pentosans increases. In the case of the rabbit, the difference in the digestibility of the cellulose and the pentosans is also more marked in the blind intestine.

On the basis of these experiments it is stated that the digestion of starch differs essentially from the decomposition of cellulose in the alimentary canal. The products of the digestion of starch and cellulose must, therefore, be very different. Hence the nutritive value of the substances in question must be quite different, not to mention the difference in loss of energy due to digestion.

As to the nature of the digestion of pentosans, the similarity of the changes in the different parts of the alimentary canal indicates that the nature and the products of their digestion resemble those of cellulose rather than those of starch.—P. FIREMAN.

The digestibility of some nonnitrogenous constituents of certain feeding stuffs, G. S. FRAPS (*North Carolina Sta. Bul. 172, pp. 49–68, 70–80*).—Using the data obtained in digestion experiments made with sheep on several feeding stuffs, reported in earlier bulletins of the station (E. S. R., 10, p. 667; 11, p. 276), and one on timothy hay not yet reported, the author estimated the digestibility of several constituents

of the carbohydrate group. The methods followed are described. The following table summarizes the results obtained:

Coefficients of digestibility of different constituents of the carbohydrate group—Experiments with sheep.

	Total dry matter.	Total sugars.	Nitrogen-free extract.	Nitrogen-free extract less sugars.	Total pentosans.	Pentosans in nitrogen-free extract.	Nitrogen-free extract less pentosans and sugars.	Crude fiber.	Pentosans in crude fiber.	Crude fiber less pentosans.	Pentosans left by 2.22 per cent acid.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Timothy hay No. 1	......	100	60.3	53.5	55.8	58.1	50.1	52.3	46.9	53.3	34.2
Crab-grass hay No. 1 (average of 2 sheep)	......	100	49.7	47.5	63.1	61.0	32.7	67.3	69.9	67.0	......
Crab-grass hay No. 2 and cowpea meal (average of 2 sheep):											
Whole ration	70.9	100	76.6	74.8	65.9	66.5	77.7	64.4	62.5	64.6	......
Cowpea meal	86.7	100	95.4	95.0	76.1	76.1	97.4	39.2	......	39.2	......
Crab-grass hay No. 1 and corn bran (average of 2 sheep):											
Whole ration	......	100	74.6	73.5	69.2	70.4	77.1	59.8	46.3	61.7	......
Corn bran	......	100	80.3	79.5	71.6	71.6	86.1	50.8	......	50.8	......
Green rape No. 1 (average of 2 sheep)	88.5	100	93.8	92.5	94.6	95.7	91.4	90.0	84.6	90.4	......
Green rape No. 2 (average of 2 sheep)	81.0	100	89.2	87.9	91.9	93.2	86.5	84.0	75.9	84.6	......
Crab-grass hay No. 1 and rice bran (average of 2 sheep):											
Whole ration	59.7	100	65.9	64.6	60.4	64.4	66.6	55.8	60.3	52.6	......
Rice bran	64.7	100	80.4	79.9	53.5	57.3	85.0	19.1	......	......	......
Timothy hay No. 2 (average of 2 sheep)	51.3	100	56.2	51.1	55.9	57.0	46.0	53.8	52.0	54.1	......

The experiments are discussed in relation to similar work at other stations. The author's principal deductions follow:

"Sugars are found in all feeding stuffs, sometimes in large percentages are completely digested, and their determination is of importance in the case of hays and cotton-seed meal. Subtraction of sugars from the nitrogen-free extract of hays reduces its digestibility appreciably. With concentrated feeding stuffs the reduction is slight.

"The total pentosans are distributed between the nitrogen-free extract and the crude fiber. The former are here called true pentosans, the latter pseudo-pentosans. The true pentosans have a higher coefficient of digestibility than the pseudo-pentosans. They form from 79.3 to 100 per cent of the total pentosans. True pentosans and sugars make up from 22 to 52.6 per cent of the nitrogen-free extract.

"The constituents of the nitrogen-free extract can be arranged in the following order, according to their digestibility: (1) sugar, (2) starch, (3) pentosans, (4) remainder. Crude fiber may be divided into pseudo-pentosans and residue. The pseudo-pentosans make up from 0 to 14.4 per cent of the crude fiber, and are less digestible, as a rule."

Cod-liver oil for calves (*Bd. Agr.* [*London*], *Rpt. Agr. Education and Research, 1899–1900, pp. 107–109*).—The Yorkshire College reports tests of the value of cod-liver oil as a substitute for milk fat and for meal in feeding calves. Calves fed on whole milk for 12

weeks gained 1.8 lbs. per day. Those fed about a half ounce of cod-liver oil in addition to separator skim milk gained 1.6 lbs. per day; while those fed separator skim milk and a mixture of linseed meal, oat meal, rice meal and locust-bean meal, 2:1:1:1 (so-called calf meal), gained 1.3 lbs. per head daily.

"The result of the experiment indicates that cod-liver oil can be recommended with some confidence as a substitute for cream and also for meal in rearing calves, but caution should be exercised in the use of cheap brands of cod-liver oil: in the above experiments the oil used was of the very best quality. No experiments were made to demonstrate whether more than 2 oz. of oil per day would be beneficial. A larger quantity appeared to keep the bowels too open, but this looseness of the bowels seemed to be quite distinct from ordinary scour, inasmuch as the calves were not unthrifty."

The value of whole milk for the production of veal, H. HAYWARD (*Pennsylvania Sta. Rpt. 1899, pp. 142–159*).—Details are given of 2 tests of the value of whole milk for calves. In the first test 6 calves from 3 to 14 days old, ranging in weight from 59 to 85 lbs. at the beginning of the trial, were fed. The average weekly gain ranged from 9.1 to 16 lbs. in the first 4 weeks. Up to this time the calves had consumed on an average 393.2 lbs. of milk containing 17.5 lbs. of fat. If they had been sold at this time at 4½ cts. a pound, the author calculates that they would have brought $4.73 per calf, an equivalent of $1.20 per hundred for the milk consumed. "If the amount of butter fed the calves during this period is estimated in the usual way by adding 12½ per cent to the butter fat, the equivalent price of butter would have been 24 cts. per pound." The feeding was continued for 4 weeks longer, the average weekly gain being 12½, 13.8, 6.75 and 13.2 lbs., respectively. The amount of milk required per pound ranged from 7.4 to 18.1 lbs., and the amount of fat from 0.38 to 0.77 lb. Two of the calves were sold at the end of the sixth week of the test, 2 at the end of the seventh, and the remaining 2 at the close of the trial.

On the basis of the data obtained in this and the following tests the author calculates the relative value of butter fat when made into butter or when used for the production of veal, when this ranges from 4 to 6½ cts. per pound.

A second test was made with 8 calves weighing from 58 to 80 lbs. at the beginning of the trial, the calves being fed whole milk from about 5 to 7 weeks. According to the author, "with a feeding period a little over 6 weeks in length, the average veal calves paid 95.7 cts. per hundred for milk testing approximately 4.05 per cent, or 20.9 cts. for butter thus consumed. The average yearly price paid for butter on the Elgin Board of Trade in 1898 was 18.8 cts. If from this is deducted the cost of making, the net price will be a little more than 15 cts., or about 6 cts. less per pound than could be obtained for it if fed to veals and sold at 4½ cts. per pound at 6 weeks of age."

From the 2 tests the following conclusions are drawn: "New whole

milk fed to average calves until they were 7 weeks old yielded more satisfactory returns than if it had been manufactured into butter and sold at the average market price for creamery butter. There was little difference in the amount of milk required to produce a pound of gain from the first to the seventh week of feeding, the average being 9.8 lbs. of milk testing 4.2 per cent fat."

Corn, Kafir corn, and alfalfa as beef producers, F. C. BURTIS (*Oklahoma Sta. Rpt. 1900, pp. 84–89*).—Using 4 lots of 5 steers each, averaging about 976 lbs. in weight the feeding value of Kafir corn meal and corn-meal feed with alfalfa hay and with corn stover was tested. In 112 days the average daily gains of the steers on the different rations were as follows: Kafir corn meal and alfalfa, 2.34 lbs.; corn meal and alfalfa, 2.54 lbs.; Kafir corn meal and Kafir corn stover, 2.33 lbs.; and corn meal and Kafir corn stover, 2.01 lbs. The grain eaten per pound of gain by the 4 lots was 7.35, 7, 10.58, and 9.3 lbs., respectively. The corresponding cost per pound of gain was 5.24, 4.92, 5.56, and 5.18 cts. The coarse fodder eaten with a bushel of grain varied from 0.43 lb. in the case of Kafir corn meal and corn stover to 0.56 lb. in case of Kafir corn meal and alfalfa.

Cotton seed and cotton-seed meal were substituted for the coarse fodder and the feeding continued for 35 days, the average daily gains of the 4 lots being 2.6, 3.2, 2.45, and 2.99 lbs., respectively. The grain eaten per pound of gain was 8.02, 6.54, 8.73, and 7.01 lbs., respectively, while the corresponding cost per pound of gain was 5.9, 4.8, 6.34, and 5.08 cts.

The steers were shipped and slaughtered. When dressed, the carcasses weighed from 59.21 to 61.71 per cent of the weight before slaughtering. The total profit on the steers was $152.48. Four pigs ran after each lot of steers, but the results obtained are not reported.

In the author's opinion the test emphasizes the value of alfalfa hay, and should encourage Oklahoma farmers to raise more of this crop.

Cattle feeding, H. T. FRENCH (*Idaho Sta. Bul. 24, pp. 12*).—The possibility of profitably fattening steers under local conditions was tested with 3 lots of 4 animals each. The steers were kept in stalls and spent a portion of each day in small yards. The test began January 1 and covered 3 months. The first month the average daily ration fed all the steers consisted of 30 lbs. of silage, 10 lbs. of grain (chopped wheat and bran, 4.6), and 5 lbs. chopped oat hay. During the second month, 20 lbs. of mangel-wurzels were substituted for the silage fed lot 1, the grain and oat hay being also somewhat modified. Lots 2 and 3 were fed much the same ration as during the first month. During the third month of the trial the rations fed all the lots were much the same as during the second, except that 10 lbs. of roots per steer was added to the rations of lots 2 and 3, the silage being decreased an equal amount. Each lot weighed somewhat over 3,400 lbs. at the beginning of the trial.

The average daily gain of the steers of the 3 lots was 1.20, 1.72, and 1.37 lbs. The steers were slaughtered, the average dressed weight being a little over 60 per cent of the live weight. According to the author, the quality of the meat was all that could be desired. The fat and lean were well distributed, and the fat was light in color. The financial aspect of the test is discussed, the average profit per steer being estimated at $12.52.

"While the average daily gain was not wholly satisfactory, it will compare favorably with that made by cattle fed in the corn States. The results are sufficiently encouraging to warrant more stock feeding in this section. Two-year-old steers can be matured on the grains and fodders produced in this section. There is a profit in keeping steers for winter feeding instead of selling an inferior and cheaper product in the fall. Corn silage can be successfully used in feeding steers in this locality."

Economical production of beef, C. F. CURTISS and J. A. CRAIG (*Iowa Sta. Bul. 48, pp. 340–372, figs. 9*).—Feeding tests extending over a number of years are reported. Regarding the possibilities of combined dairying and feeding for beef production, a feeding experiment with 14 steers, begun in December, 1896, and covering 2 years, is reported. The feeding of these animals as calves has been previously noted (E. S. R., 9, p. 973). During the test considered as a whole, the steers were fed skim milk, different grains, and coarse fodders, etc. The average daily gain in the whole period was 1.72 lbs. per head; the cost of a pound of gain, 4.09 cts. The steers were sold in Chicago, the dressed weight being 64.4 per cent of the live weight. The total profit per head was $12.22.

"From the results so far obtained through these trials it is evident that a system whereby dairying and meat making may be combined is the most promising in profits. Not only do the steers from cows bred with this combination in view yield as much profit as those from the range, but the returns from the cows when used for dairy purposes makes the combination much more remunerative. The data secured through the actual work of establishing a herd of this kind and the actual test of the cows in the dairy and steers in the feed lot show that it is not only possible to combine these qualities to a profitable degree, but also to perpetuate them if the herd is bred especially for them.

"In the economical production of beef through a combination of dairying and beef making it is very necessary that the calves are removed from their dams when 2 or 3 days old so as to develop and preserve the milking qualities of the cows. This necessitates the feeding of skim milk to the calves and . . . . the best returns are made when corn meal is fed as an additional food in preference to oil meal, oatmeal, or flaxseed."

The value of wide and narrow rations was tested with 2 lots of 7 steers each (this comparison being a part of the first test reported above). The ration was made up of a number of grains and coarse fodders. From July 16, 1897, to August 1, 1898, lot 1 was fed a narrow ration, the nutritive ratio being 1:3:9, and lot 2 was fed a wide ration, the nutritive ratio being 1:7.6. The average daily gain of the steers in lot 1 was 1.93 lbs., the dry matter eaten per pound of gain 7.63 lbs., and the cost of food per pound of gain 4.02 cts. Similar

values for lot 2 were 1.91 lbs., 7.73 lbs., and 3.52 cts. After the close of this period the steers were fed until December 9, 1898, a ration with the nutritive ratio of 1:6.5. During this period the average gains of the 2 lots were 1.12 and 1.32 lbs.; the dry matter eaten per pound of gain, 20.54 and 17.43 lbs., and the cost of food per pound of gain, 9.15 and 8.92 cts., respectively.

"The results support the statement that the narrow ration is likely to give the greatest gains, while the wide ration is more favorable to cheap gains. The relative cheapness of these rations will largely depend on local conditions, whether or not the farm grains grown in the community are representative of the carbonaceous or nitrogenous foods."

In testing the possibility of profitably fattening range steers, 17 such animals were fed January 26, 1898, to April 6, 1900. During the winter corn and corn fodder were the principal feeding stuffs used, as it was desired to make the test with such foods as were generally available locally. During the summer the steers were pastured. The average daily gain per steer during the whole test was 1.35 lbs.; the cost of a pound of gain, 4.10 cts; the dry matter eaten per pound of gain was 10.19 lbs. the first winter, 11.75 lbs. in the second, and 12.96 lbs. in the third. At the conclusion of the test 3 of the steers were sold in the local market for 4.5 cts. per pound, and the remainder in Chicago for 5.45 cts. per pound. The authors compute that in this test the profit was $8.16 per steer.

"The feeding of range steers with the application of present prices for feeders and the fattened product does not permit of securing much profit in comparison with the returns that may be secured from a herd and its products bred for the special purpose of meeting the conditions of a combination of dairying with beef making."

Steer feeding, D. O. NOURSE (*Virginia Sta. Bul. 105, pp. 183–187*).—Whole corn and corn-and-cob meal in combination with other foods were compared for a period of 4 weeks with 7 steers, each weighing about 1,200 lbs. A steer fed corn on the ear, bran, whole oats, and hay lost in this time 5 lbs. One fed corn-and-cob meal, ground oats, bran, and hay gained 78 lbs. When cotton-seed meal replaced ground oats in the ration, a third steer gained 94 lbs. With corn silage in addition to this last ration, one of the steers gained 18 lbs., and with corn stover in place of hay and silage another gained 2 lbs. With 2 steers corn-and-cob meal was the only grain fed. One received hay and the other corn stover as coarse fodder. The former gained 9 lbs. and the latter lost 53 lbs. According to the author—

"Ground corn seemed better than whole corn, especially when fed dry. A considerable variety of food seems desirable. Corn alone, as it is with other foods generally, does not give the best returns. Corn silage, as one portion of the coarse fodder, is desirable.

"The largest gain obtained was with rations containing cotton-seed meal. The only animal refusing grain at any time was one whose grain ration was composed of corn alone."

Fattening range lambs, C. F. CURTISS and J. A. CRAIG (*Iowa Sta. Bul. 48, pp. 452–456*).—In discussing the fattening of range lambs 2 trials are reported. One of these has been noted from a previous publication (E. S. R., 9, p. 977). In the second trial, which included 191 lambs and covered 105 days, the average daily gain per lamb was 0.23 lb., the cost of food per pound of gain 4.3 cts., and the dry matter eaten per pound of gain 10.74 lbs. The food supplied included oats, bran, corn, oil meal, roots, hay, and corn fodder. Judged by results of the 2 experiments, the authors believe that "there are fair profits to be made from fattening range lambs under the conditions of our State."

Fattening lambs in comparison with yearlings, C. F. CURTISS and J. A. CRAIG (*Iowa Sta. Bul. 48, pp. 457–460*).—Two tests on the comparative economy of feeding lambs and yearlings are reported, the results of the first being quoted from a previous publication (E. S. R., 9, p. 75). In the second test 10 lambs and 10 yearlings were fed for 91 and 70 days, respectively, oats, corn, oil meal, hay, beets, and corn fodder. The average weight of the lambs at the beginning of the trial was 90.2 lbs. and the yearlings 147.7 lbs. The average daily gain in the 2 lots was 0.29 and 0.23 lb., respectively; the cost of food per pound of gain 4.78 and 5.51 cts., and the dry matter eaten per pound of gain, 11.22 and 14.65 lbs. Both lots were sold and slaughtered. The dressed weight of the lambs was 50.7 per cent of the live weight; of the yearlings, 55.6 per cent. The authors believe these trials show the superior value of lambs. "In view of the fact that the lambs also bring a higher price on the market and they may be also marketed earlier, the selection of them for winter feeding seems to be much more preferable than to buy yearlings for this purpose."

A study of pork production from the standpoint of the farm and the market, C. F. CURTISS and J. A. CRAIG (*Iowa Sta. Bul. 48, pp. 373–451, pl. 1, figs. 22, dgms. 2*).—The work reported extended over 3 years, beginning with 1896. Data are reported on pigs and sows before weaning and on pigs alone after weaning. In these tests the comparative value of Berkshires, Poland Chinas, Chester Whites, Duroc Jerseys, Yorkshires, and Tamworths was tested, crossbred Tamworths and Yorkshires being also included in the first trial. Considering the different breeds in the order mentioned the average cost of a pound of gain in the 3-year test by the sows and pigs before weaning was 4.29, 3.15, 3.27, 5.61, 1.83, and 2.22 cts., respectively. The cost in the case of the crossbred pigs was 6.80 cts. The average cost of a pound of gain by pigs of the different breeds after weaning was 2.33, 2.23, 2.46, 2.27, 2.14, and 2.42 cts., respectively, and 2.81 cts. by the crossbred pigs (tested only 1 year). In the third trial the comparative value of wide and narrow rations was also tested with 2 lots of 5 Durocs each. The cost of food per pound of

gain on the narrow ration was 2.26 cts. and on the wide ration 2.01 cts.

The value of different breeds for dressed pork and bacon is discussed, many statistics of the export trade of pigs and the manufactured bacon being given. Considering the average cost per pound of gain before weaning, the breeds ranked as follows: Yorkshire, Tamworth, Poland China, Chester White, Berkshire, and Duroc Jersey; considering the average cost per pound of gain after weaning: Yorkshire, Poland China, Duroc Jersey, Berkshire, Tamworth, and Chester White. The Yorkshires gave the largest dressed weight in proportion to weight before slaughtering, being followed by the Poland Chinas, Tamworths, Chester Whites, and Berkshires and Duroc Jerseys in the order mentioned. As regards the total value of cuts in carcasses, the breeds ranked as follows: Yorkshire, Tamworth, Poland China, Duroc Jersey, Chester White, and Berkshire; as regards quality of meat, *i. e.*, a satisfactory mixture of fat and lean, they ranked as follows: Tamworth, Berkshire, Chester White, Duroc, Poland China, and Yorkshire. The Tamworths were considered most suitable for export trade, the Yorkshires least so, while the Berkshires, Chester Whites, Durocs, and Poland Chinas ranked next to the Tamworths, in the order mentioned.

In connection with one of the tests reported above, extended chemical studies of the composition of the flesh of the different breeds were made by the Division of Chemistry of this Department (E. S. R., 10, p. 877).

"While the testimony of these experiments is most strongly directed toward emphasizing the necessity of securing the right type of a hog as represented in the bacon breed, yet the results show that the question of feeding is one of equal importance. . . . It was very manifest that the feeding of a wide ration or one rich in carbonaceous materials resulted in a carcass excessively fat, while the feeding of a narrow ration, or one rich in nitrogenous materials, made a carcass containing more or less meat or muscle. [*i. e.*, type for bacon.]

. . . . "If a division of this industry into the raising of bacon hogs as well as the production of lard pigs is brought about, so that the 2 types are distinctly recognized in the market, it would seem very evident that it would materially help the price of the lard hog. The creating of a demand for a new product would necessarily lighten the competition in the other direction, which it is natural to suppose would result in stronger prices. Instead of desiring to check the development of bacon production it would seem the best policy for the hog breeder to try and encourage it by producing the type and feeding for the purpose of satisfying the bacon market."

Poultry experiments (*Utah Sta. Bul. 67, pp. 121–159, pls. 6*).—Continuing previous work (E. S. R., 11, p. 480), tests are reported on the relative value of pullets and hens, early and late hatched pullets, and the effect of exercise on egg production. The feeding value of corn, dried blood, and sunflower seed as a part of the ration was also tested. The test began with 15 lots of 5 pullets or hens each and covered 1 year. The breeds used were Leghorns, Wyandottes, and Plymouth Rocks. With the exceptions noted, all the lots were fed

in the morning a mash composed of bran, ground oats, and corn, 2:1:1, seasoned with salt and cayenne pepper. Four lots, however, had dried blood added to the mash—that is, these lots were fed a ration with a narrower nutritive ratio than the other lots. Wheat and oats were fed in the middle of the forenoon on alternate days, and late in the afternoon wheat. One lot received sunflower seed in the place of wheat in the forenoon, and another lot corn in place of wheat both morning and evening. Cut bones and butchers' scraps were fed three times a week, and in the winter green food in addition. Most of the feeding stuffs were analyzed. The lots with exercise were compelled to scratch for their grain ration, which was scattered in straw. The others were fed from troughs. From these and the earlier tests the author draws a number of deductions, some of which follow:

"As to the effect of exercise on food consumption, the average . . . for 3 years shows that the pen with 'exercise' consumed 62.4 cts. worth of food, and the pen 'without exercise' 60.8. In the case of 2 other pens the average was 63.5 cts. and 62 cts., respectively, per fowl in favor of 'no exercise.'

"During the year the Leghorns consumed an average of 62 cts. worth of food per fowl. The Wyandottes consumed 81.6 cts. per fowl, and 2 pens of Plymouth Rocks averaged 87.7 cts. per fowl. The Leghorns consumed during the year an average of about 75 lbs. of total food, or about 55 lbs. of dry matter per fowl; the Wyandottes 100 lbs. total food, 73 lbs. dry matter, and the Plymouth Rocks about 110 lbs. total food, and about 80 lbs. dry matter. The 3 years' results from Leghorn pullets show an average of 162 eggs per fowl per year at a food cost of 4.6 cts. per dozen. These results are not from selected or 'pedigree' layers.

"The record of weights of fowls shows that Leghorns weigh about 10 per cent more during their second year than during the first year as pullets. During the third year there is practically no increase in weight.

"The largest egg production was during the period of greatest food consumption. The smallest egg yield was when the food consumption was least. The hens attained their greatest weight immediately preceding the periods of greatest egg production. After the periods of heavy laying they showed a loss in weight.

"Five pens of Leghorns 2 and 3 years old laid eggs averaging 1.56 lbs. per dozen. Five pens of Leghorn pullets laid eggs averaging 1.37 lbs. per dozen. The eggs from the pen of Wyandotte pullets averaged 1.56 lbs. per dozen, and those laid by 4 pens of Plymouth Rock pullets averaged 1.52 lbs. per dozen. Eggs from different hens of the same breed varied in weight. The eggs from 5 pens of Leghorn pullets averaged 1.44 lbs. per dozen. The eggs from the same pens during the second year averaged 1.54 lbs. per dozen. In other words, the size of the eggs was 8 per cent greater the second year than the first.

"A test of wheat *v.* corn gave results in favor of wheat for egg production. In the case of Leghorn pullets the addition of dried blood to the ration considerably increased the egg yield. With Plymouth Rock pullets no effect was noticed on the yearly record. With both, the pens having dried blood began laying earlier than the others. The discarding of corn (except the little used in the mash) and substituting a small quantity of sunflower seed did not materially affect the egg yield, there being but a slight increase. Owing to the greater cost of the sunflower seed, the financial results were in favor of the corn. The results of a test with Leghorn pullets showed that a nutritive ratio of 1:4.95 was much superior to one of 1:6.66. With Plymouth Rocks the results were inconclusive."

A caponizing experiment is also briefly reported. A cockerel and capon, each weighing 1.9 lbs. at the beginning of the test, were fed for about 10 months under the same conditions. The capon then weighed 7 lbs., the cockerel 6.4 lbs. Although there was little difference in weight in the two cases, the meat of the capon when cooked was regarded as of superior quality, as was also the appearance of the dressed bird.

Aspects of mental economy, M. V. O'SHEA (*Bul. Univ. Wisconsin No. 36, pp. 33–198, figs. 18, charts 3*).—As stated in the subtitle, the author discusses some phases of the dynamics of the mind and records observations on the students at the University of Wisconsin. These include the kind and amount of food consumed, statistics regarding living habits, etc. On the basis of his observations and a review of some of the literature of the subject, a number of deductions regarding the value of different foods, etc., are drawn. These are not always in harmony with the commonly accepted conclusions of physiologists and specialists in nutrition. The lack of references to the great mass of the recent scientific work on the topics discussed is noticeable.

Compendium for food chemists, A. BUJARD and E. BAIER (*Hilfsbuch für Nahrungsmittelchemiker. Berlin: J. Springer, 1900, 2. ed., pp. XXIII+454+155, figs. 8; rev. in Ztschr. Untersuch. Nahr. u. Genussmtl., 3 (1900), No. 8, pp. 590, 591*).—This edition has been revised and enlarged.

Flesh foods with methods for their chemical, microscopical, and bacteriological examination, C. A. MITCHELL (*London: Charles Griffin & Co., Ltd., 1900, pp. XV+336, pl. 1, figs. 58*).—As the subtitle explains, this book is designed as a practical handbook for physicians, analysts, inspectors, and others interested in the topics discussed. The structure and composition of flesh foods, their methods of examination and preservation, and similar topics are treated of, the author's purpose being to collect and summarize the records of the many investigations which have been reported in English and foreign publications relating to these subjects.

Air, water, and food from a sanitary standpoint, ELLEN H. RICHARDS and A. G. WOODMAN (*New York: John Wiley & Sons; London: Chapman & Hall, Ltd., 1900, pp. 226, pl. 1, figs. 10*).—In a manner designed to suit the needs of students the authors treat of such topics as air, the problem of ventilation, water—its sources and properties; water as a possible carrier of infection; food and nutrition, and food adulteration. The important analytical methods necessary for chemical analyses and examinations connected with these topics are described. Many tables useful in computing results of analyses and a somewhat extended bibliography of the subjects treated of are also included.

Chemical foods in modern times, E. EICHENGRUN (*Ztschr. Angew. Chem. 1900, No. 11, pp. 261–269*).—In an address the author discusses some of the recent food preparations, such as albumoses, peptones, malt preparations, and the like.

Certain determinations introduced in the analysis of bread, A. SCALA (*Staz. Sper. Agr. Ital., 32 (1899), pp. 489–498*).—The composition (including calculated digestibility and power to absorb water) of a number of samples of bread is reported. One of the samples was made in part and another entirely from Indian corn.

The acidity of flours, MARION and MAGNET (*Ann. Chim. Anal. et Appl., 5 (1900), p. 164; abs. in Bul. Assoc. Belge. Chim., 14 (1900), No. 5, p. 233*).—Experiments are reported and modifications of Balland's method of determining acid suggested.

The manufacture and adulteration of sausages, M. H. MARTEL (*Public Health, 12 (1900), No. 8, pp. 636–638*).—This is an abstract of an article in *La Presse Médicale*, January 24, 1900. The author describes and discusses the principal methods of adulterating sausages—*i. e.*, (1) by the addition of antiseptic substances, of pre-

servative salts in excess, or of coloring matters; (2) by the addition of starch, flour, rice flour, and breadcrumbs; (3) by the use of flesh of animals which have died naturally or have been slaughtered on account of disease; (4) by the use of parts of animals not usually eaten (as the hides of oxen); and (5) by the use of the flesh of such animals as the dog, cat, and horse. The methods of detecting adulteration are discussed in some considerable detail.

Notes on vinegar, J. EDMUNDS (*British Food Jour., 2 (1900), No. 20, pp. 210–214*).—Discussing malted vinegars, the author states that on account of watering and bad brewing most of them contain only about 3 per cent of acetic acid. These vinegars tend to spoil and hence manufacturers often have to resort to the addition of sulphuric acid to preserve them. A good malted vinegar should contain about 6 per cent of acetic acid, but not more than 0.01 to 0.03 per cent of sulphuric acid.—C. B. WILLIAMS.

Nutrition investigations in California, M. E. JAFFA (*U. S. Dept. Agr., Office of Experiment Stations Bul. 84, pp. 39*).—Four dietary studies of infants, one of a football team, and one of a family are reported, as well as digestion experiments with an infant and determinations of the balance of income and outgo of nitrogen. A number of foods were analyzed in connection with the studies.

Composition of Apios tuberosa, C. BRIGHETTI (*Staz. Sper. Agr. Ital., 33 (1900), pp. 72–75; abs. in Jour. Chem. Soc. [London], 78 (1900), No. 453, II, p. 498*).—Analyses of the ground nut.

The digestibility of some nonnitrogeneous constituents of certain feeding stuffs, G. S. FRAPS (*Jour. Amer. Chem. Soc., 22 (1900), No. 9, pp. 543–553*).—Noted from another report of this work. (See p. 667.)

How far is sugar to be recommended as a feeding stuff? F. LEHMANN (*Braunschweig. Landw. Ztg., 68 (1900), Nos. 10, pp. 39, 40; 11, pp. 46, 47; 12, pp. 51–53; 13, pp. 57–59*).—A general discussion, quoting the work of a number of investigators.

Beet molasses feeding stuffs, GERLACH (*Bl. Zuckerrübenbau, 7 (1900), No. 6, pp. 92–94*).—The value of several molasses feeds is discussed.

Analyses of prickly pear, F. B. GUTHRIE (*Agr. Gaz. New South Wales, 11 (1900), No. 8, pp. 671–674, pl. 1*).—Analyses of the leaves of different sorts of prickly pear are reported and their feeding value discussed.

Stock feeding, F. C. BURTIS (*Oklahoma Sta. Rpt. 1900, pp. 120–131*).—A general article on feeding farm animals, with tables showing the composition of common feeding stuffs.

Experimental pig feeding, J. MAHON (*Queensland Agr. Jour., 7 (1900), No. 1, pp. 23, 24*).—Results of tests for the purpose of ascertaining the value of cane molasses when combined with other foods. Pigs fed ground barley required 5.5 lbs. for a pound of gain and those fed barley and molasses, 5.08 lbs.

Pig-feeding experiments (*Bd. Agr. [London], Rpt. Agr. Education and Research, 1890–1900, pp. 113–116*).—Two pig-feeding experiments at University College, Nottingham, are briefly reported. In the first scalded maize meal was compared with raw maize meal, no advantage being found for the former method of feeding. Both lots were fed whey in addition to the maize meal. In the second test sweet and sour separator skim milk were compared; some grain, principally maize meal, being fed in addition. The conclusion was drawn that the feeding value of skim milk was not increased by souring, but, if anything, slightly diminished.

Swine feeding especially relating to the use of succulent foods, C. S. PLUMB (*Nat. Farmer and Stock Grower, 4 (1900), No. 1, pp. 74–78*).—A popular article gathered from various sources and read before the Indiana Swine Breeders' Association, January, 1900.

Fundamental principles of feeding horses for light and heavy work, J. SHIROKIKH (*Arch. Vet. Nauk., St. Petersburg, 30 (1900), Nos. 2, II, pp. 64–87; 3, II, pp. 122–142*).—A general discussion of the subject.

Trout culture for farmers, W. E. MEEHAN (*Pennsylvania Dept. Agr. Rpt. 1899, pt. 1, pp. 312-323*).—Raising trout is recommended as a profitable enterprise for farmers, and directions are given.

Trade in agricultural commodities—animals for slaughter and meat products, A. DULAC (*Ann. Agron., 26 (1900), No. 9, pp. 430-472*).—A comprehensive article on the commercial side of animal husbandry, with special reference to animals bred for slaughter.

DAIRY FARMING—DAIRYING.

Corn silage, sugar beets, and mangels—a comparison of their value as dairy foods, H. J. WATERS and E. H. HESS (*Pennsylvania Sta. Rpt. 1899, pp. 111-123*).—A feeding experiment with 3 lots of 3 cows each and covering 3 thirty-day periods is reported. During the entire test all the cows were fed daily 7 lbs. of mixed grain and 6 lbs. of field-cured corn stover. During periods 1 and 3 all the cows received in addition silage, sugar beets, and mangels, each in quantities furnishing 2 lbs. of digestible dry matter. During period 2, in addition to the grain and stover, lot 1 received 6 lbs. of digestible dry matter in silage; lot 2, 6 lbs. in sugar beets; and lot 3, 6 lbs. in mangels. The results of the test showed a slight increase in the amount of butter, and percentages of fat and solids-not-fat in changing from the mixed ration of silage, sugar beets, and mangels to silage alone, and a slight decrease in changing from the mixed ration to either sugar beets or mangels alone. They are considered, however, as showing no practical difference in the effect of silage and roots upon the yield and quality of milk, but the mixture of silage and roots is considered slightly better than the same quantity of either fed separately.

A brief summary is given of previous experiments at the station along this line (E. S. R., 3, p. 718; 6, p. 446; 7, p. 976).

Rye meal and Quaker-oats feed for milk production, H. HAYWARD (*Pennsylvania Sta. Bul. 52, pp. 8*).—An experiment covering 3 periods of 35 days each was conducted with 9 cows to compare Quaker-oat feed and rye meal as feeding stuffs for milch cows. The cows were divided into 3 lots. All 3 lots during the first and third periods and 1 cow in each lot during the second period were fed a control ration made up of $2\frac{1}{2}$ lbs. of cotton-seed meal, $3\frac{1}{2}$ lbs of corn meal, 2 lbs. of new process linseed meal, and timothy hay *ad libitum*. During the second period the corn meal was replaced, respectively, by the same quantity of Quaker-oat feed and rye meal, and these contrasted rations were each fed to 1 cow in each lot. Variations in the live weight of the animals were small. The average cost per pound of milk and fat was highest on the rye-meal ration and lowest on the corn-meal ration.

"Rye meal, fed as part of a properly balanced ration, did not materially decrease the flow of milk, but was nearly if not quite as efficient as an equal weight of corn

meal. The very slight difference observed is probably referable to the slightly greater digestibility of the corn meal.

"Quaker-oat feed, similarly fed, caused somewhat more decrease in the production of milk than did rye, but the effect was very slight and no greater than would be expected from the probably lower digestibility of the Quaker-oat feed."

The feeding value for milch cows of the solids-not-sugar in molasses, E. RAMM and C. MOMSEN (*Milch Ztg., 29 (1900), No. 28, pp. 433–436*).—A brief summary is given of a feeding experiment previously reported (E. S. R., 9, p. 876), in which molasses proved superior to sugar. In the experiment here reported 5 cows were fed for 4 periods of 4 days each (preceded by preliminary periods) a basal ration of hay, straw, roots, and peanut meal. In addition molasses (*Restmelasse*) was fed during the first and fourth periods, raw sugar during the second period, and raw sugar and molasses distillery residue (*Melasseschlempe*) during the third period, the sugar content of the 3 rations being the same. The cows produced the most milk and the least butter fat when fed the sugar ration, and the most fat and solids when fed the sugar and molasses distillery residue. The content of fat and solids in the milk produced on the molasses ration was, respectively, 3.20 and 11.65 per cent, on the sugar ration 2.84 and 11.32 per cent, and on the sugar and molasses residue ration 3.39 and 12.06 per cent. The results are therefore considered as showing that molasses has a greater feeding value for dairy cows than sugar, and that the constituents in molasses other than sugar are especially valuable in the production of butter fat.

The composition of milk and milk products, H. D. RICHMOND (*Analyst, 25 (1900), Sept., pp. 225–231*).—Data are summarized for over 29,000 samples of milk analyzed in the laboratory of the Aylesbury Dairy Company. The average for the year was 12.67 per cent of solids and 3.74 per cent of fat; the lowest fat content occurred in June and the highest in October. The author deduces a considerable number of analyses to show that "all milks, abnormal or otherwise, conform to the following two rules, which are practically different modes of expressing the same fact: (*a*) The solids-not-fat, less the milk sugar, calculated on the milk devoid of fat, amount to at least 4 per cent; (*b*) the sum of the specific gravity degrees and the fat, less 4 times the milk sugar, exceeds 16."

Timpe's[1] view that there is a constant relation between the proteids and fat in genuine milk and his proposition to detect adulteration by a divergence from this relation are discussed at considerable length. The author takes exception to Timpe's deductions.

Tests were made of paraphenylene-diamin and metaphenylene-diamin for distinguishing between fresh and boiled milk. The latter, together with amyl alcohol, was recommended as the best reagent.

[1] Chem. Ztg., 23 (1900), p. 1040 (E. S. R., 12, p. 286).

The composition of clotted cream, the water content of butter, and analyses of 2 samples of butter made with a butter increaser are given. The latter contained over 20 per cent of water.

Milk preservatives, C. B. COCHRAN (*Pennsylvania Dept. Agr. Rpt. 1899, pt. 1, pp. 277–289*).—The author discusses the use of boric acid and formaldehyde in preserving milk and the physiological action of these antiseptics on man and the lower animals. The literature of the subject is reviewed, tests are given for the detection of boric acid and formaldehyde, and results of experiments by the author are briefly noted. The antiseptic power of formaldehyde in milk was found in experiments to be about 50 times as great as that of boric acid. No difference was observed in the artificial digestion of pure milk and milk to which formaldehyde had been added at the rate of 1 to 10,000. Formaldehyde added in large quantities (1:1,000 to 1:200) to milk at the time of renneting or 6 hours before retarded or prevented coagulation and in other respects modified the action of the rennet. Minnows and tadpoles withstood quite well a 1 to 50,000 solution of formaldehyde, remaining alive from 4 to 6 days, while they died in a few hours in a solution of corrosive sublimate of the same strength. "When we bear in mind the fact that minnows are exceedingly sensitive to most poisons and that the formaldehyde must have been present in the blood and in every tissue to the extent of 1 part in 50,000, it shows that some animal tissues, at least, stand formaldehyde very well." Microscopical paramecia showed considerable ability to withstand dilute formaldehyde for a time. The author prefers formaldehyde to boric acid as a milk and cream preservative, on the ground that it is less injurious and that "it is impossible to use formaldehyde in excessive amounts, since its presence is then betrayed by the sense of taste." Objections to the use of preservatives in milk are considered.

Investigations on the cause of the rancidity of butter, R. REINMANN (*Centbl. Bakt. u. Par., 2. Abt., 6 (1900), Nos. 5, pp. 131–139; 6, pp. 166–176; 7, pp. 209–214*).—From a review of the literature on the subject and the experiments covering a variety of conditions, the author arrives at the following conclusions: (1) The amount of free acid formed in butter bears no relation to the rancid taste and odor. (2) A high content of casein and milk sugar in butter is very favorable to rancidity. (3) The oxygen of the air is not of the importance in the production of rancidity in butter which has been claimed, since sterile cream butter does not become rancid with the free access of air. (4) Light does not appear to be of any importance in this connection. (5) Under ordinary conditions butter made from sterilized cream does not become rancid. Rancidity can be induced, however, in a few days by working into it a very small quantity of rancid butter. (6) The question as to whether the rancidity of butter is due to the action of micro-organisms or ferments is still an open one.

Examinations of the chemical properties of Danish butter fat, E. HOLM and P. V. F. PETERSEN (*46. Rpt. Kgl. Vet. Landbohöjskoles Lab. Landökon. Forsög* [*Copenhagen*], *1900, pp. 106*).—This work was extended over 4 years, 1896 to 1900, 7,834 samples of butter from about 800 creameries being examined, as well as butter from individual cows on different farms.

Examination of butter fat in Danish creamery butter.—The refractive index of all samples ranged between 48.6 and 54.9, over 80 per cent of the samples being between 51 and 52. There was practically no difference in the index of butter from different parts of Denmark, and but slight difference between that from large estates and creameries. Regular seasonal changes were observed in the refractive index, Reichert number, and iodin number. The average refractive index for 4 years, Reichert number for 3 years, and iodin number for 2 years are shown below:

Average results for Danish butter fat per month.

Month.	Refractive index.	Reichert number.	Iodin number.
April	51.0	30.1	*a* 33.4
May	51.1	30.0	*a* 35.0
June	51.1	30.4	*a* 37.1
July	51.6	30.2	*a* 38.4
August	52.1	28.8	*a* 39.0
September	52.6	27.5	41.6
October	52.8	27.5	44.0
November	51.0	29.6	36.6
December	50.2	30.7	33.0
January	50.5	30.9	*a* 33.3
February	50.6	31.0	*a* 34.5
March	50.8	30.9	*a* 34.1
Average	51.3	29.8	36.7

a One year only.

The highest values for refractive index and iodin number are coincident with the lowest Reichert numbers, a gradual increase or decrease of the latter being accompanied by a change in the opposite direction of the former. A difference of 1° in the refractive index was found to correspond to a difference of about 3 in the iodin number.

Forty-four samples of artificial butter of Danish, Swedish, Norwegian, Dutch, and German origin gave refractive indexes ranging from 57 to 61.5°, the minimum, therefore, being 2.1° above the maximum for pure Danish butter. Mixtures of artificial and natural butter fat containing 10 to 90 per cent of the latter gave a refractive index identical with the calculated index in all cases.

The authors show that the quality of butter and its commercial value stand in no relation to its composition, and that a perfect guarantee of purity can not be established by means of chemical standards.

Examination of butter fat from individual cows.—Six cows were selected from each of 3 Danish dairy farms, 2 of each lot being fresh milkers, 2 in about the middle of their lactation periods, and 2 old

milking cows. The results of examinations of the butter, monthly, for a year showed in the case of both new and old milkers that the refractive index of the butter fat and the iodin number increased considerably when the cows were let out in the spring, and decreased when they were changed to stable feeding in the fall.

The changes in the refractive index and iodin number during the period of lactation follow each other closely, decreasing during the first 3 months after calving, to increase from that time on until the cows are dry; while the Reichert number changes but little up to the fifth month after calving, from which time on there is a steady decrease till drying-off time.

The variations in the case of individual cows are tabulated and compared with those for creamery butter. The general conclusion is drawn that variations in the chemical properties of Danish export butter are not due to adulteration, as has occasionally been claimed, but are caused by the natural variations in the butter fat from the individual cows.—F. W. WOLL.

On the biology of peptonizing milk bacteria, O. KALISCHER (*Arch. Hyg., 37 (1900), No. 1, pp. 30–53*).—The author's investigations were made with a bacterium belonging to the group of hay or potato bacilli, which, according to Flügge, are not killed by heating milk to 90–95°. It possessed the property of curdling milk by means of a rennet-like ferment and then of dissolving the precipitate of casein by means of a peptonizing ferment. The investigations showed that its growth in milk was accompanied by a diminution in the milk sugar, which is believed to be directly connected with the life process of the bacteria. The inversion of the sugar took place entirely within the cell, and no ferment capable of inverting milk sugar was formed. The only decomposition products of the milk sugar which could be identified with certainty were volatile acids. The fat was not attacked by the bacteria, and no diastatic ferment was elaborated. The products of its action on casein were albumose and later peptone, together with ammonia, volatile fatty acids, and a number of other substances. By fermentative action alone there was produced from the casein peptone, leucin, and tyrosin, the aromatic oxy acids, and ammonia in small quantity. Except in its ability to produce oxy acids, the digestive ferment corresponded entirely to trypsin. The rennet ferment produced by the bacterium was very analogous to ordinary rennet.

Studies on the enzyms of cheese, O. JENSEN (*Ann. Agr. Suisse, 1 (1900), No. 5, pp. 159–198*).—The object was to study the enzyms found in cheese, and the rôle they play together with bacteria in the ripening processes. Limburger is taken as a representative of the soft, while Emmenthaler is chosen as a type of the hard cheeses.

The author finds 2 enzyms active in the ripening processes of the 2 cheeses, galactase of milk and pepsin of rennet. These enzyms

pass into the curd in the process of manufacture in sufficient quantity to produce transformation in the casein. The soft cheeses, by reason of the methods of their manufacture, are from the first richer in enzyms than the hard cheeses, those made by pressure.

To determine the presence of galactase the methods of Babcock and Russell were followed (E. S. R., 11, p. 578). As an antiseptic to prevent the growth of bacteria 1 per cent formalin was usually employed, but in some cases ether was used, owing to the restraining action of formalin upon the action of galactase. This action of formalin is used as a means of showing the degree of the activity of galactase in cheese ripening. Analyses of the 2 cheeses at different periods are given, showing the content of soluble nitrogen, nitrogen not precipitated by phosphotungstic acid, nitrogen in the form of ammonia, and lactic acid.

Just after making Limburger cheese contains a considerable amount of lactic acid, which favors the action of the pepsin and restrains the action of the galactase. At the beginning the ripening of Limburger cheese is due wholly to the action of the pepsin. This action is limited little by little by the action of more energetic enzyms, while the acid present is diminished by the ammonia formed. This action is naturally most active at first at the surface of the cheese, the action proceeding toward the interior. From the investigations the author concludes that the transformation of the casein during the ripening of Limburger cheese is the result of a digestive fermentation in which the surface of the cheese is the point of beginning, and that this fermentation is due to the action of yeast or bacteria aided at the outset by a digestive pepsin operating throughout the mass.

The previous work of the author on the ripening of Emmenthaler cheese has been noted (E. S. R., 11, p. 980). The ripening of this cheese is accompanied by the processes of salting and drying that in a measure restrain the different fermentations. Owing to the pressure in the manufacture this cheese contains at the beginning less lactic acid than the soft cheeses, which is perhaps favorable to the action of the galactase while in a measure restraining the action of the pepsin. From his investigations the author concludes that the transformation of the casein during the ripening of Emmenthaler is the result of a bacterial fermentation, in a degree digestive, equally distributed in the cheese and probably aided in the beginning by the action of galactase.

Variations in the fat content of the milk of individual cows, I. Boy-Esens (*Milch Ztg., 29 (1900), No. 32, pp. 501–503*).—This consists of data from the records of a number of herds.

A new apparatus for the condensation of milk and other liquids, O. Henzold (*Milch Ztg., 29 (1900), No. 26, pp. 401–403, figs. 3*).—The apparatus is figured and described and tests are reported. No vacuum is required.

Milk poisoning in Malta, T. Zammit (*British Med. Jour., 1900, No. 2054, pp. 1151, 1152*).

The variability of lactic acid bacteria with reference to their capacity for souring milk, N. P. Schierbeck (*Arch. Hyg., 38 (1900), No. 3, pp. 294–315*).—It

was found possible by experimental means to produce a variation of the lactic acid bacteria exhibiting a very marked decrease in fermentative ability, and this variation was perpetuated without change through a long series of inoculations. The culture obtained is not regarded as a new type, since the decrease in ability to produce acid appears to be due to unavoidable conditions in the nutritive medium.

Butter making for select trade and exportation, M. E. McDonnell (*Pennsylvania Dept. Agr. Rpt. 1899, pt. 1, pp. 263–277*).—The author gives notes on the dairy industry in Europe and discusses methods of manufacture and qualities required in butter, especially that intended for shipment to foreign countries. The topics considered include the handling of milk, pasteurization of cream and skim milk, selection and use of a starter, securing uniformity in ripening, and churning, working, salting, coloring, packing, and storing butter.

The suppression of goat's milk in the manufacture of Emmenthaler cheese, R. Steinegger (*Milch Ztg., 29 (1900), No. 31, pp. 486, 487*).—Experiments are cited as showing the inferiority of goat's milk as compared with cow's milk in the manufacture of this cheese.

VETERINARY SCIENCE AND PRACTICE.

Report of the State veterinarian, L. Pearson (*Pennsylvania Dept. Agr. Rpt. 1899, pt. 1, pp. 144–184*).—It is stated that the repressive measures adopted against glanders have resulted in the nearly complete extermination of this disease in the State. Anthrax was reported from 12 counties during the year, and animals were vaccinated against this disease on 83 different farms. The author believes that the spread of anthrax is due largely to the neglect of anthrax carcasses, which should be burned with great care. Blackleg was reported from 8 counties during the year. It is recommended that blackleg carcasses should be burned, as in the case of anthrax. Rabies occurred in 12 counties among dogs, horses, hogs, sheep, cattle, and man. Observations made on cerebro-spinal meningitis indicate that contaminated water may be favorable to the outbreak of this disease. During the year, 56,387 doses of tuberculin were sent out from the laboratory for testing dairy cows and breeding cattle in the State. Hog cholera occurred in 16 counties. The outbreaks in most instances were traceable to infected hogs shipped from the West or South. Malignant dysentery of calves may be controlled, according to the author, by the removal of cows from the infected premises 6 or 8 weeks before the calves are born. Brief notes are also presented on actinomycosis, contagious ophthalmia, and sheep scab.

Summary of the year's pathological investigations, J. A. Gilruth (*Veterinarian, 73 (1900), No. 870, pp. 301–315*).—Brief notes are given of an outbreak of actinomycosis. The author studied a number of cases of parasitic gastritis in calves. The disease was quite general and occurred chiefly during the winter months. The symptoms were acute and watery diarrhea lasting from 14 to 28 days, and resulting in death. The disease was due to a parasitic worm (*Strongylus cervicornis*). The author believes the predisposing causes to this disease

were found in improper feeding and lack of shelter, which lowered the vitality of the animals.

Red water is reported as prevalent in certain districts, especially on dairy farms, where it was invariably associated with injudicious feeding of turnips.

The chloral hydrate treatment for milk fever is reported as giving satisfactory results in the hands of many farmers. The Schmidt treatment has been tried with still better results.

Notes are also given on the etiology and treatment of cirrhosis of the liver in cattle and sheep, septicæmia in domesticated animals, acute congestion of the kidneys in lambs, etc.

Annual report for 1899 from the principal of the Royal Veterinary College, J. McFadyean (*Jour. Roy. Agr. Soc. England, 3. ser., 11 (1900), No. 1, pp. 93–109*).—The author gives brief notes on the prevalence during the year of anthrax, glanders, pleuro-pneumonia, rabies, and swine fever. Considerable work was done on tuberculosis in cattle and in sheep, 11,151 tuberculin tests in cattle having been reported during the year. The percentage of tuberculous animals was 24. Brief notes are given on the symptoms and course of tuberculosis of the udder. One case of tuberculosis in sheep is reported and the author states this is the first indubitable case among British sheep. Suspected material from this sheep was inoculated into rabbits and resulted in producing the typical lesions of tuberculosis.

The author makes a report on a new disease of the dog which was observed in various parts of southern England and is believed to be identical with the disease which was reported as very fatal to dogs in parts of Germany during the autumn of 1898. The principal symptoms of the disease were prostration and vomiting. About 75 per cent of the cases were fatal and the average duration of the disease was from 4 to 6 days. The disease is readily distinguishable from distemper by the fact that it attacks more frequently old dogs.

Brief notes are presented on sarcoptic mange of cattle, the African horse-sickness, and the curability of glanders. The last two subjects have already been referred to at greater length (E. S. R., 12, p. 292).

Plasmodiophora brassicæ as a cause of tumors in animals, W. Podwyssotzki (*Centbl. Bakt. u. Par., 1. Abt., 27 (1900), No. 3, pp. 97–101*).—The author instituted experiments in hypodermic and intraperitoneal inoculations of this organism in rabbits, guinea pigs, frogs, and axolotl. Tumors of true parasitic origin were produced and the author states the results of his experiments as follows: Tumors may be produced in animals by inoculation with *Plasmodiophora brassicæ*. The tumors are of mesodermal origin and arise as the result of a hypertrophy and proliferation of the thick connective tissue. Spores of this organism are formed in the cells of the tumors either singly or in large numbers. The spores are present in larger numbers in the

older tumor cells than in those of more recent origin. The nucleus of the cells which are filled with spores is rich in chromatin considerably enlarged and shows a decided proliferation. In some of the spores a progressive metamorphosis of their nuclear substance occurs, as the result of which 2 or 3 nuclei appear in the place of one. In the tumors produced by *Plasmodiophora brassicæ*, the phagocytosis which was caused by the presence of the organism seemed always sufficient to bring about the ultimate destruction of all the parasites.

White scour in calves (*Farmers' Gaz., 59 (1900), No. 3, p. 50*).—Ten cows were divided into 2 lots of 5 each. In lot A the cows were fed in the ordinary way, but the calves, as soon as born, were put in a clean house, and fed 4 times a day a small quantity of new milk with a little warm water in it. Each calf was fed separately, and after 3 weeks received a little separated milk and barley meal. In lot B the cows were fed for about a month before calving on 10 lbs. of bran and meal mixed in the morning and evening. The milk from these cows was given to their own calves, each calf being fed 3 times a day for a fortnight. After this period they were fed twice a day on fresh milk mixed with separated milk and barley meal.

The results of these experiments indicate conclusively the importance of careful feeding of calves and constant attention to cleanliness. No calves died from lot A while 2 died out of lot B, and of 14 calves treated in the ordinary way, 9 died.

A report on tuberculosis of cattle, L. PEARSON and M. P. RAVENEL (*Pennsylvania Dept. Agr. Rpt. 1899, pt. 1, pp. 323-533*).—The authors present a general historical account of the development of knowledge concerning this disease, together with a discussion of the means and extent of distribution, prevalence, importance, and methods for controlling this disease. From numerous tests made by the Pennsylvania Live Stock Sanitary Board, 12.2 per cent of cattle in the State reacted to tuberculin.

Experiments were conducted with guinea pigs which were kept in a compartment in the lower end of nosebags attached to tuberculous cows. The guinea pigs were thus forced to breath the air expired by the tuberculous animals. Twelve guinea pigs were used in these experiments, and were exposed for periods varying from 2½ to 26 hours. None of them became infected. Two lots of guinea pigs inoculated with tuberculosis were kept in light and dark boxes, respectively. One lot was placed in a box with a glass front and the top and back made of wire netting covered with white cloth. The other lot was placed in a box of equal size made of wood painted black inside and a wire netting back covered with black cloth. The guinea pigs in the light box lived from 5½ to 6 days longer than those in the black box. This experiment indicates the effect of light in checking the development of tuberculosis.

Experiments were made upon 3 tuberculous cows well fed upon a wide ration, with the result that all 3 cows improved noticeably in condition for a period of a year before yielding to the general progress of the disease.

The authors discuss the problem of checking tuberculosis by good conditions of life and sanitation, the relation of bovine tuberculosis to public health, the disposition of the flesh of tuberculous animals, the pathological anatomy and bacteriology of tuberculosis, the nature of tuberculin, the symptoms of tuberculosis, the value of the tuberculin test, and the measures adopted in different countries for the suppression of this disease. An account is given of the regulations of the State sanitary board for the control of tuberculosis. Detailed reports are given from herd owners on losses from tuberculosis and on the condition of inspected herds.

The danger of spreading tuberculosis by means of milk, and regulations for preventing this danger, KÜHNAN (*Berlin. Tierärztl. Wchnschr., 1900, No. 5, pp. 49–52*).—This article contains a critical review of the literature upon the subject of tubercle bacilli in cows milk. The commission of the German Dairy Union has recently adopted resolutions, which are in the nature of a proposed bill, providing that all milch cows are to be inspected with reference to the presence of tubercle bacilli in their milk. The milk of suspected cows before being used must be heated to a temperature of 85° C. Every cow which is found suffering from tuberculosis of the udder is to be destroyed, and indemnity is provided ranging from \$12 to \$75.

Experimental researches on symptomatic anthrax, E. LECLAINCHE and H. VALLÉE (*Ann. Inst. Pasteur, 14 (1900), No. 4, pp. 202–223*).—The authors give a brief critical review of the literature relating to the micro-organism of symptomatic anthrax and discuss the biology of this organism. The organism is strictly anaerobic, and it is difficult to obtain pure cultures. The organism of symptomatic anthrax produces a toxin which is capable in itself of producing serious lesions and death. The pure spores when deprived of the toxin are unable to germinate or produce an infection even when introduced into the tissues in large doses. The resistance of the organism to symptomatic anthrax depends upon phagocytic action. All conditions which prevent or hinder phagocytosis are favorable to infection.

Experiments in the treatment of infectious mammitis of cows, E. ZSCHOKKE (*Landw. Jahrb. Schweiz, 14 (1900), No. 2, pp. 56–62*).—The author presents tables showing the percentage of infectious mammitis as determined by the examination of milk samples, from 1894 to 1899. Tables show that the disease has become more frequent from year to year. It is most common during the summer months, or during the time when the greatest yield of milk is obtained. The disease appears as an enzootic or epizootic. From 2 to 4 animals became infected one

after the other in each of 4 different localities. In some cases the micro-organisms occurred in short chains or masses, while in others they were in long chains. These are believed to be mere forms of one species of streptococcus. Inoculations of 20 cc. of fresh milk from a cow suffering from infectious mammitis were made into the udder of 2 healthy cows and 2 goats. One of the cows and one of the goats developed the disease in the ordinary period of from 3 to 5 days. The other goat proved to be immune, while the second cow gave signs of the disease after a period of 2 weeks. Therapeutic experiments were tried on a pregnant cow, which was infected in 3 quarters of the udder with this disease. The green fodder which the animal had recently received was replaced with hay. After a period of 20 days the milk of this animal became clear and there was less sediment, and one week later the streptococci entirely disappeared from the udder. The animal had recovered without treatment. Experiments in injecting iodid of potash 1:1,000 parts and itrol 1:4,000 parts in lukewarm water into the infected quarter of the udder after milking were without effect in destroying the micro-organisms. The same was true where antistreptococcus serum was tried, up to 30 gm. per day for 4 days.

The colloidal silver preparation also had no effect in curing the mammitis, 50 gm. of this substance in a 1 per cent aqueous solution being injected into the jugular vein. Better results were obtained by the use of citrate of silver in the form of a salve containing 2 parts citrate of silver, 10 parts of camphor, and 88 parts of oil. This salve was thoroughly rubbed into the skin of the udder for a period of 8 days in the case of a cow infected with mammitis in all 4 quarters. The milk gradually became clearer and the number of streptococci diminished until the milk was found to be normal at the end of 16 days. Experiments with a salve containing cantharides indicated that this substance when thoroughly rubbed upon the skin of the udder produced a cure, or decided improvement, in every case. The secretion of milk, however, was much diminished, and either ceased entirely or remained much below the normal. It was found that even when all possible antiseptic precautions were observed the disease was spread by drawing milk from an infected quarter of the udder and that the other quarters of the same udder, or the udders of other cows, were more apt to become infected than when the milk from infected udders was not drawn. Accordingly it is recommended to cease milking parts of the udder affected as soon as the disease is discovered.

Stomach worms in sheep, J. F. Hickman (*Ohio Sta. Bul. 117, pp. 197–212, figs. 2*).—Rather serious losses of sheep have been experienced in Ohio since 1896 from attacks of a stomach worm (*Strongylus contortus*). The author gives a brief description of the worm and an account of the method of infection, the symptoms, and the forms of treatment which have already been recommended for this parasite.

Experiments with the turpentine remedy were not satisfactory, and in the summer of 1898 the author began experiments with the benzine treatment as recommended by Prof. C. Julien. Gasoline was substituted for benzine as being more conveniently purchased. One tablespoonful of common gasoline was emulsified in about 4 oz. of flaxseed tea and given as a drench to each lamb. This treatment seemed to check the trouble, and no deaths occurred after the treatment was begun. In applying this method the lambs were housed in the evening and kept with nothing to eat until 10 o'clock the following day. The gasoline was then administered and the lambs kept without food or drink for 3 hours longer. This treatment was given for 3 days in succession, and after an interval of a week the same 3 days' treatment was repeated. If improvement is not noticed in all the flock, the third treatment should be given after an interval of 10 days.

In the spring of 1899 the station began an experiment to determine the method of infection by this worm. A number of lambs of different breeds were divided into 2 equal lots, lot 1 being kept in after reaching the age of 1 month, and lot 2 allowed to feed on the pasture with the ewes. In lot 2, 7 lambs died and all of them were given the gasoline treatment. Lot 1 was kept in until the middle of September, when they were allowed to pasture on a patch of rape. No deaths occurred in this lot.

The feed for lot 1 up to September 20 cost about 14⅓ cts. per head more than for lot 2, but 7 head of lambs were lost from lot 2, so that the estimated cost of each lamb up to September 5 was 65 cts. in lot 1, and 91 cts. in lot 2. The gain in weight was greater in lot 2 than in lot 1, the difference varying from 3 to 5 lbs.

The labor involved in keeping the lambs housed is perhaps the greatest objection to this method of preventing infection, but this difficulty would be partly removed by having rape for early pasture for these lambs, and by turning them on second crop clover.

Certain difficulties have been experienced by some sheep men in administering the gasoline treatment, but the author thinks these difficulties can be largely avoided by setting the sheep on its rump before giving the drench.

In the experiments carried on by the station, 1,000 doses of gasoline were given with the drench bottle with the loss of but one sheep. The condition and behavior of sheep subsequent to treatment with gasoline indicates that this method does not injure the digestive system.

The action of desiccation and heat on sheep-pox virus, L. Duclert and A. Conte (*Ann. École Nat. Agr. Montpellier, 11 (1899-1900), pp. 141-154*).—During experiments conducted by the authors it was found that desiccated sheep-pox virus preserved for 14 hours at the freezing point did not lose its virulence. Previous experiments had shown that a temperature of 25° C. was most favorable for

producing a gradual modification of the virulence of this virus. Desiccated sheep-pox virus was subjected to this temperature for periods varying from 14 to 24 days. The inoculation of experimental animals was performed each day during the time that the virus was exposed to this temperature. A gradual diminution in virulence was noticed after the sixteenth day. A temperature of 30° C. was found to produce a too rapid and irregular modification of the virulence.

A diagnostic lesion in rabies, J. A. GILRUTH (*Veterinarian, 73 (1900), No. 870, pp. 315–319*).—The lesions heretofore described as diagnostic of rabies, such as vascular lesions, pigmentary atrophy, rabic tubercles of Babes, and the cellular lesions of Golgi, are considered unreliable. Peculiar lesions have been discovered in the peripheral, cerebro-spinal, and sympathetic ganglia which are regarded as specific in character. The action of the rabies virus is made manifest by proliferation of the cells of the endothelial capsule, which causes a destruction of a number of nerve cells. It is stated that the comparison of a section of a normal spinal ganglion of the dog with a similar one taken from an animal dead of rabies renders the diagnosis extremely easy.

An outline of a law regulating the slaughter of animals and inspection of meat (*Arch. Deut. Landw. Raths, 24 (1900), pp. 45–58*).—A report on the discussion of this subject at the twenty-eighth meeting of the German Agricultural Commission.

Remarks on plague in the lower animals, F. G. CLEMOW (*British Med. Jour., 1900, Nos. 2054, pp. 1141–1146; 2055, pp. 1216–1219*).—The author gives detailed notes on the occurrence of plague in a large variety of animals, among which mention may be made of monkeys, rats, mice, squirrels, guinea pigs, marmots, rabbits, dogs, cats, horses, sheep, goats, pigs, cattle, vultures, etc. Rats may become infected with this disease from the soil, grain, flesh of other animals, rags, and insects.

An experiment in the transmission of syphilis to two calves, M. P. RAVENEL (*Jour. Comp. Med. and Vet. Arch., 21 (1900), No. 5, pp. 264–268*).—Two experiments were made upon calves, during which syphilitic material was rubbed into scarifications of the skin. The subsequent history of these cases indicated clearly that the disease was not transmitted to the calves. Both calves were tuberculous, and this may be of significance from the known fact of the especial susceptibility of tuberculous human patients.

An outbreak of tuberculosis among cattle at an altitude of 7,000 feet, S. W. McCLURE (*Jour. Comp. Med. and Vet. Arch., 21 (1900), No. 7, p. 410*).—Five years previous to the outbreak of tuberculosis on this ranch, a Jersey bull had been imported from an eastern breeder. The bull later developed symptoms of tuberculosis and died. Three other cattle belonging to the herd died with the same symptoms. On investigation by the author, 5 other animals were found to be tuberculous and were killed and examined. These cattle had not been in a stable, but were allowed to range freely under conditions which would seem to be exceedingly unfavorable for the development of tuberculosis.

Tuberculosis of the udder in cows, A. BERGSTRAND (*Landtmannen, 11 (1900), No. 27, pp. 425–428*).—This is a detailed discussion of the results obtained by Kühnan in his investigations on this disease.

Tuberculosis of the udder, H. LERMAT (*Jour. Agricole [Paris], 11 (1900), No. 126, p. 161*).—Brief statistical notes on the prevalence of mammary tuberculosis.

Note on examination of milk for tubercle bacilli, E. W. HAMMOND (*Jour. Comp. Med. and Vet. Arch., 21 (1900), No. 7, p. 395*).—The author dilutes milk which is to be examined with an equal quantity of water. It is then centrifugalized for about half an hour by means of an electric centrifuge. The sediment is then removed with a fine pipette and a drop of this substance placed on a clean cover glass, dried, and finally stained by the ordinary method: As a result of diluting milk with an equal quantity of water, so little fatty material is thrown down in the sediment that it is unnecessary to use ether or other reagents to dissolve out the fat.

Tuberculin investigations (*Landtmannen, 11 (1900), No. 25, pp. 402-405*).—A summary of the results from tuberculin injections with notes on the tuberculin problem in different parts of Sweden. Rather conclusive evidence is obtained in 1 case of the transmission of tuberculosis from man to animals.

The most important tuberculins; their preparation and differences, BAUERMEISTER (*Arch. Wiss. u. Prakt. Thierh., 26 (1900), No. 4-5, pp. 301-324*).—The author gives a detailed discussion of the different methods of preparation and different composition of about 30 kinds of tuberculin. Some tuberculins contain certain constituents of the media upon which the tubercle bacilli were grown while other tuberculins are so prepared as to exclude all substances except the immediate products of the tubercle bacillus.

Measures to be adopted against outbreaks of anthrax in summer, W. W. FLACH (*Landtmannen, 11 (1900), No. 20, pp. 309-315*).—A general account of the means of transmission of anthrax, together with a discussion of the sanitary measures which should be adopted to prevent the spread of this disease.

Means of preventing Texas fever, L. L. LEWIS (*Oklahoma Sta. Rpt. 1900, pp. 26-28*).—Popular notes on the etiology and methods of treatment for this disease.

Blackleg: Its nature, cause, and prevention, A. T. PETERS (*Nebraska Sta. Bul. 65, pp. 107-132, figs. 8.*)—This bulletin contains a popular discussion of the general subject of blackleg, including the symptoms and etiology of the disease, and detailed directions for making preventive vaccinations against blackleg.

A comparative study of the bacillus of malignant œdema and of blackleg, E. LECLAINCHE and H. VALLÉE (*Ann. Inst. Pasteur, 14 (1900), No. 9, pp. 590-596*).—From inoculation experiments with these micro-organisms, the authors conclude that there is a close biological connection between the two. The organisms may be differentiated by the fact that in the serous fluid of specific œdema, in the peritoneum of the guinea pig, the bacillus of malignant œdema appears in the long forms which are regularly absent in the case of the bacillus of blackleg. The methods of immunization which are applicable to blackleg may also be used against malignant œdema. Immunization of an animal against blackleg does not imply an added resistance to the bacillus of malignant œdema.

Pneumomycosis due to Aspergillus fumigatus, L. PEARSON and M. P. RAVENEL (*Jour. Comp. Med. and Vet. Arch., 21 (1900), No. 8, pp. 451-465, figs. 4*).—The authors give a critical review of the literature of this subject, together with notes on the cultivation and description of the mold. A Jersey cow after giving evidence of a diseased condition for a period of 6 months died, and upon examination the lungs were found to contain large quantities of the hyphæ and fruiting heads of *Aspergillus fumigatus*. The lung most affected was exceedingly emphysematous and gave a crackling sound on being rubbed. The cow did not react to the tuberculin test which was given some time before death, but upon post-mortem examination 4 or 5 caseous calcareous nodules were found in which the tubercle bacillus was present. It is suggested that the infection by the mold may have interfered with the turberculin test.

On carcinoma in cattle, L. LOEB and G. JOBSON (*Jour. Comp. Med. and Vet. Arch., 21 (1900), No. 7, pp. 385-394*).—In the 2,514,446 head of cattle received at the Chicago Stock Yards during the year 1899 49 cases of carcinoma were found. In all

60 cases of carcinoma were examined by the authors, of which 59 were in cows and only one was in a steer. One of the most frequent locations for the beginning of carcinoma in cattle is in the eyelid in cases where foreign bodies enter the conjunctival sac through the running of the tear fluid and the motion of the nictitating membrane of the eye. In the study of these cases the authors noted a constant absence of metastasis in the deep lymph glands and other organs.

Sorghum as stock food, W. THOMPSON (*West Virginia Farm Rev.*, *8* (*1900*), *No. 9*, *pp. 287, 288*).—This article is reprinted from the *Louisiana Planter.* The author relates the circumstances of loss of stock from eating sorghum on his own estate, and suggests that the explanation of fatal results from eating sorghum is not to be found in poisonous principles, but rather in the sticky nature of sorghum leaves, which causes them to adhere to the larynx, thus strangling the animals.

The susceptibility of camels to rinderpest, TARTAKOWSKY (*Arch. Sci. Biol.* [*St. Petersburg*], *8* (*1900*), *No. 1*, *pp. 11–36*).—Numerous experiments by the author indicate that while rinderpest assumes a mild form in the camel, the disease may, nevertheless, be carried by such animals and they should be included in quarantine regulations for the prevention of rinderpest.

Hog cholera, L. L. LEWIS (*Oklahoma Sta. Rpt. 1900*, *pp. 29–32*).—Brief notes on the causes, symptoms, and treatment of this disease.

Swine fever, A. H. CORY (*Queensland Agr. Jour.*, *7* (*1900*), *No. 3*, *pp. 279–281*).—The author describes the chief symptoms of various infectious swine diseases, of which swine fever, swine erysipelas, and swine plague are the most important.

Some difficulties associated with the eradication of swine fever, E. PEACEY (*Jour. Comp. Path. and Ther.*, *13* (*1900*), *No. 3*, *pp. 236–239*).—Notes on methods for diagnosing this disease and for distinguishing it from swine erysipelas and from necrotic pneumonia of swine. These 3 diseases are considered by the author to be the epizootic diseases of the pig.

Second contribution to the study of the morphology of Bacillus mallei, B. ALLERIO (*Centbl. Bakt. u. Par.*, *1. Abt.*, *28* (*1900*), *No. 12–13*, *pp. 353–359*, *figs. 26*).—The author describes in detail the various forms assumed by the glanders bacillus when grown upon different cultural media. White mice have been quite generally stated to be refractory to glanders. Inoculation experiments by the author on white, gray, and black mice resulted in the death of the white mice after 18 days with numerous small glanderous tubercles. The black and gray mice did not become infected.

Hydrophobia, C. W. EDDY (*Agr. Student*, *6* (*1900*), *No. 8*, *pp. 158, 159*).—A discussion of the symptoms of rabies, especially in the dog, with notes on the mortality of this disease.

The rapid diagnosis of rabies, M. P. RAVENEL and D. J. MCCARTHY (*Jour. Comp. Med. and Vet. Arch.*, *21* (*1900*), *No. 7*, *pp. 404–406*).—The authors examined the spinal cord, medulla, and intervertebral ganglia in 6 cases of rabies which were submitted for diagnosis. Two of the cases were dogs and 4 rabbits. The tissues were sectioned for the most part without embedding, although celloidin was used in some cases. In all cases constant changes were noted in the intervertebral ganglia. The ganglia from rabbits showed the most advanced changes. In both dogs distinct changes were produced in the cells of these ganglia and their capsules. The medulla of all cases were examined for the rabic tubercles of Babes. These tubercles were present in 5 out of 6 cases, but the method is not considered so practical for rapid diagnosis as the other just described.

Antirabies vaccination in St. Petersburg, V. KRAIOUCHKINE (*Arch. Sci. Biol.* [*St. Petersburg*], *8* (*1900*), *No. 1*, *pp. 96–101*).

TECHNOLOGY.

Studies on cider (*Semaine Agr., 20 (1900), No. 1004, p. 255*).—A brief review is here given of a report by L. Seguin and F. Pailhert of investigations on the comparative value of diffusion and of grinding and pressure for cider-making at the National School of Agriculture at Rennes. The results secured in these trials are summed up as follows: (1) By diffusion as concentrated a must can be obtained as the pure juice of the apple; (2) cider obtained from the same lot of apples is of equal value, whether made from juice obtained by diffusion or by pressure; and (3) fermentation takes place with equal rapidity in apple musts of equal density, whether obtained by diffusion or by pressure.

From analysis it was found that maceration increased the yield, and also the sugar, acidity, mucilage, and the ash in the musts and diminished the tannin in solution. "If the pulps are exposed for a long time to the air or frequently shoveled over, the tannin disappears and the musts are nearly colorless."

Investigations into the manufacture of cider, F. J. LLOYD (*Bd. Agr. [London], Rpt. Agr. Education and Research, 1899–1900, pp. 133–136*).—The specific gravity, solids, and acids of 64 samples of fresh juice from the press examined during 7 years (1893–1899) are reported, and accounts are given of the successful use of thin cloths in the presses; the injury to cider by the evolution of hydrogen sulphid in casks which had been sulphured, or "matched," previous to use; an examination of early-made juice which showed that it does not contain anything which should prevent the production of good cider, in spite of the tradition that early-made cider is never good; a trial of selected yeasts which showed that "a far better cider can be produced by the employment of a selected yeast than by the uncontrolled miscellaneous fermentation which is now mainly relied upon to produce cider;" and an investigation of "oily" cider which indicated that this trouble, like ropiness in milk, is due to a living organism, the nature of which was not determined. Mixing oily cider with pomace and repressing was apparently effective in correcting the defect.

Wines and wine making, A. G. FORD (*Oklahoma Sta. Rpt. 1900, pp. 76–83*).—This article discusses the principles of wine making, describes the methods in common use, and reports analyses of 17 samples of Oklahoma wines, analyses of 7 of these samples being repeated at the end of a year to determine the changes which had taken place. It was found that at the end of the year there was a slight decrease in alcohol and an increase in acids and solids.

The practical recommendations made are as follows: "Everything about the winery should be kept perfectly clean; only sound, ripe grapes should be used; the temperature during fermentation should be kept between 75 and 85° F.; the wines should be racked until no further sediment is deposited."

Theoretical and practical treatise on the manufacture of beet sugar, P. Horsindéon (*Traité théorique et pratique de la fabrication du sucre de betterave. Paris: E. Bernard & Co., 1900, 2. ed., vols. 2, pp. XI+1092, pls. 5, figs. 207*).

Cane sugar, W. L. Bass (*New York: W. L. Bass, 1900; pt. 1, pp. 47, figs. 5; pt. 2, pp. 52, figs. 19; pt. 7, pp. 36, figs. 2; pt. 10, pp. 23, fig. 1*).—Contents: pt. 1, Defecation and elimination; pt. 2, Transportation; pt. 7, Scum and by-products; pt. 10, Bagging and handling.

Rational fermentations (vinegar, cider, hydromel, alcohol), G. Jacquemin (*Les fermentations rationnelles (vins, cidres, hydromels, alcools). Malzéville—Nancy: E. Thomas, 1900, pp. VII + 878, pls. 20, figs. 57*).

Cotton-plant by-products (*Tradesman, 44 (1900), No. 7, p. 60*).—Discusses briefly the proposed utilization of cotton hulls for paper making and a process for removing gum from the oil, thus giving it quick-drying properties and fitting it for use as a substitute for linseed oil.

On the peat industry, H. Steinmetz (*K. Landtbr. Akad. Handl. Tidskr., 39 (1900), No. 2, pp. 109–111*).

AGRICULTURAL ENGINEERING.

Wells and windmills in Nebraska, E. H. Barbour (*Water Supply and Irrigation Papers, U. S. Geol. Survey, No. 29, pp. 85, pls. 27, figs. 25*).—In addition to an account of homemade windmills and other water lifts which have already been reported on in a bulletin of the Nebraska Station (E. S. R., 11, p. 896) this bulletin discusses the importance of the water resources of Nebraska; the action of water underground, including sheet water, artesian water, conservation of soil moisture, pollution of water, surface and seepage water, and fluctuations of water level; methods of raising water in general; precipitation in Nebraska; surface water available for irrigation; supply for towns and cities; salt water; and blowing wells.

"The subject-matter of this paper is related to water conservation in the small way. Throughout the Great Plains region the supply of water is so scanty and so widely disseminated that as a rule it will be impracticable to provide great storage reservoirs or other works of considerable magnitude. On the other hand, for the utilization of the resources there must be innumerable attempts to employ the small amount of water almost everywhere available; and this can be done most economically through the use of the ever present force of the wind. Thus windmills throughout at least one-fourth of the United States must ever be inseparably connected with the utilization of wells and with the development of the country."

Water resources of the Lower Peninsula of Michigan, A. C. Lane (*Water Supply and Irrig. Papers, U. S. Geol. Survey, No. 30, pp. 97, pls. 7, figs. 14*).—"This material is a portion of the outcome of Dr. Lane's studies in connection with the geological survey of the State of Michigan, supplemented by statements received in reply to circulars sent throughout the Lower Peninsula of Michigan to well drillers and others likely to be well-informed and interested in the subject. The facts thus gathered have been collated with the result of 2 months' field work during the autumn of 1897." Only the general conclusions from this work are presented in this bulletin, detailed data

regarding analyses and descriptions of the supply at different places being omitted. The report discusses the uses of the waters of this region for navigation, transportation, power, and domestic and technical purposes, as well as the climate of the region and its superficial geology and topography, and deeper wells and Paleozoic stratigraphy.

Barns, D. O. NOURSE (*Virginia Sta. Bul. 106, pp. 191–208, pls. 4, figs. 2*).—The specifications of a wooden hillside barn erected at the station at a cost of between \$6,000 and \$7,000 are given in full and the plans are briefly discussed. The main features of the barn are a hay and grain barn facing north, back of which are box stalls with storage space above, silos at the ends, and 2 wings with stalls for stock, running north and south, and partly inclosing an open court.

"The hay and grain barn, 40 by 100 ft. in size, faces the north, and loads may be taken in at this side and on the second floor. By this means all grain, as corn, oats, mill feed, etc., may be conveyed to bins at the left, and run by chutes to the mixing and feed room below.

"Over these bins is a large space, in which hay or fodder may be kept. At the right, on entering the driveway, is a space 40 by 42 ft., and extending from 12 ft. below driveway to comb of roof 30 ft. above it. This can be conveniently divided into 9 spaces for various kinds of hay, to be fed to classes of animals as desired. All hay is unloaded from wagons by hay carrier. . . . While unloading, the wagon stands on a set of five-ton hay scales, offering an easy opportunity for weighing all hay and grain products. Close by the cribs is a corn mill, and the meal, as it is ground, drops to the feed room below. . . .

"Beneath the driveway will be placed a gasoline engine to run the machines mentioned, besides the silage cutters, etc. The walls of the engine room are to be of metal, except the back, which will be the foundation wall. . . .

"At the eastern end of the lower floor is situated an office. . . . Next that is a herdsman's room. . . . In the rear of this room is an apartment set off for keeping the supplies needed about the barn—shovels, forks, sacks, oil, rope, etc.

"Leaving the hay barn downstairs, we step into a long feeding passage in front of the box stalls. Of these there are 10, each 9 by 10 ft. in size, arranged with a small door leading to the passage in front, and most of them with doors outward to the open court. These are used for bulls, farrowing cows, and young calves. Above the passage mentioned is a long room, 10 by 80 ft., entered by a door from the driveway above, that will be used for various purposes, mainly for the keeping of rough fodders used in experiment work."

Of the 2 wings opening out of the feeding passage the west is arranged for 12 horses, 24 head of young heifers and bulls, and 40 steers; the east is arranged to accommodate 52 milch cows. Special precautions were taken to provide an abundance of light and air in these wings.

"They are 10 ft. from the floor to the plate behind the cattle, 18 ft. 6 in. to the plate over the animals' heads, and 23 ft. 6 in. to the comb of roof. . . .

"The center over feeding floor runs up with vertical sides above the roof over the cattle. By this means we get windows that swing on pins in the center of sash, that may be opened for ventilation. By a series of cords that run through sash pulleys, these windows may be partly or fully opened, and all on one side at once. These, with the ventilators on the top of the wings, windows in rear of the animals, and the

many doors, offer ample means for obtaining fresh air, and at the same time, all odors of the cattle are kept from the feed. The floors under the cattle are of 2-in. oak, laid with lead joints, making them water tight. The manure gutters are 18 in. wide, 6 in. below the floors on which the cattle stand, and 4 in. below the floor in their rear. Length of floor for stock depends on size, from 4 ft. for yearlings, 4½ ft. for mature Jerseys, to 5 ft. for heavy steers. Feeding floor in front of all is 9 ft. wide. Various means for confining the animals are used for illustrative purposes. . . .

"Connected with the east wing, where the dairy cattle stand, is a small room to receive the milk, prior to taking it to the creamery. It is fitted with a sink and water supply, scales for weighing milk, bottle rack for samples of milk used in testing, etc. In rear of all animals the sides of the building are all ceiled and painted. . . . The stables are fitted with four manure carriers."

Connected with each end of the feeding passage is a circular wooden silo of somewhat over 200 tons capacity, resting on a rock foundation and having an earth floor. These silos were constructed with a special view to making the sides air-tight. In each silo there are three 2 by 4 ft. doors opening into a chute connected with the feeding passage.

Ample protection against fire is provided by fire hydrants and hose in different parts of the barn.

Agricultural hydraulics, Vol. III, P. L. SALVADOR (*Hydraulique agricole. Paris: Vve. C. Dunod, 1900, Vol. III, pts. 4-8, pp. VIII+563, figs. 279*).—This is one of the volumes of the *Bibliothèque du conducteur de travaux public*, published under the auspices of the ministers of public works, agriculture, public instruction, commerce and industry, interior, colonies, and justice, of France, and discusses, in their engineering, agricultural, and legal aspects, sanitation and reclamation of swampy lands; warping; reclaiming of soils beneath the level of the sea (polders); drainage of the soil; and agricultural utilization of sewage. In the treatment of each subject the general principles and conditions are discussed and notable examples of work in the particular lines are described. The various laws of France relating to the subjects treated are given. The book is a valuable compendium of information both for the engineer and agriculturist, but its usefulness as a book of reference is seriously impaired by lack of an index.

Rating the current meter, C. T. JOHNSTON (*Wyoming Ind. Jour., 2 (1900), No. 1, pp. 10, fig. 1*).—A brief account is given of the apparatus and methods used at Cheyenne, Wyo., in testing the meters employed in the irrigation investigations of this Department.

Lifting water by compressed air, C. HOWELL (*Tradesman, 44 (1900), No. 6, pp. 89, 90, figs. 3*).—This is an account taken from the *Metal Worker* of the successful use of compressed air in pumping water for city purposes.

The limited water supply of the arid region, F. H. NEWELL (*Nat. Geogr. Mag., 11 (1900), No. 11, pp. 438-443*).—In this article the importance of storing water is shown, but it is claimed that the number of places where the conditions are suitable for the construction of storage reservoirs is limited, and that such enterprises are expensive and as a rule afford little opportunity for private profit.

Water rights according to the explanations of the civil department of cassation of the senate, D. FLEXOR (*St. Petersburg: Min. Agr. and Imp. Domains, Division of Land Amelioration, 2. ed., pp. XII+151*).

On the influence of plant cover on the flow of streams, E. WOLLNY (*Vrtljschr. Bayer. Landw. Rath., 5 (1900), No. 3, pp. 389-445*).—A discussion, based on observations by the author, of the influence of plant cover, especially forests, in mitigating floods and droughts.

Reasons for irrigation investigations and forest preservation, E. S. NETTLETON (*Wyoming Ind. Jour., 2 (1900), No. 6, pp. 145, 146*).

The evolution of the plow, F. W. TAYLOR (*Agr. Student, 7 (1900), No. 1, pp. 14, 15*).—An abstract of a thesis presented to the faculty of the Ohio State University in 1900.

The evolution and comparison of reaping machines, M. F. MILLER (*Agr. Student, 7 (1900), No. 1, pp. 9–11*).—An abstract of a thesis presented to the faculty of the Ohio State University in 1900.

Common roads, J. D. HARPER (*Industrialist, 27 (1900), No. 5, pp. 52–56, figs. 6*).—A brief nontechnical article on the construction and maintenance of dirt roads.

Road improvement in New York (*U. S. Dept. Agr., Office of Public Road Inquiries Circ. 35, pp. 15*).—This circular gives the text of the New York road law approved March 24, 1898, with explanations of its provisions and practical operation by W. W. Armstrong.

The application of acetylene illumination to country homes, G. G. POND (*Pennsylvania Dept. Agr. Bul. 57, pp. 85, pls. 2, figs. 5*).—This bulletin deals with the history, manufacture, properties, and impurities of acetylene, and describes the various appliances employed in its preparation and utilization. A bibliography is given which consists of a "limited list of references, excluding all works in languages other than English and entering only to a very slight extent into the less popular periodicals."

STATISTICS—MISCELLANEOUS.

Annual Report of Oklahoma Station, 1900 (*Oklahoma Sta. Rpt. 1900, pp. 11–141*).—This includes a report of the director on the work, publications, and staff of the station; a paper on the work of the experiment station, by J. Fields; a summary of a large number of press bulletins issued by the station; a number of articles noted elsewhere; a financial statement for the fiscal year ended June 30, 1900; and a list of the publications issued since the organization of the station.

Annual Report of Pennsylvania Station, 1899 (*Pennsylvania Sta. Rpt. 1899, pp. 343*).—This includes the organization list of the station, a financial statement for the fiscal year ended June 30, 1899, a report of the director summarizing briefly the work of the station during the year, several articles noted elsewhere, lists of exchanges and available station publications, and reprints or more detailed accounts, including full experimental data of work reported in Bulletins 44–52 of the station under the following headings: Commercial butter cultures (E. S. R., 11, p. 83); heated milk for butter making (E. S. R., 11, p. 84); variety tests of wheat (E. S. R., 11, p. 731); tests of the sugar beet in Pennsylvania (E. S. R., 12, p. 44); winter *v.* spring bran (E. S. R., 12, p. 71); field experiments with fertilizers on tobacco (E. S. R., 12, p. 339); distillery waste, miscellaneous cattle-food analyses (E. S. R., 12, p. 378); small fruits in 1899 (E. S. R., 12, p. 645); and rye-meal and Quaker oats feed for milk production (E. S. R., 12, p. 678).

Fifth Annual Report of Pennsylvania Department of Agriculture, 1899 (*Pennsylvania Dept. Agr. Rpt. 1899, pt. 1, pp. 1080*).—Included in this report are a number of articles noted elsewhere in this issue and reprints of Bulletins 54–59 of the department on the following subjects: Analyses of commercial fertilizers (E. S. R., 12, p. 39), the composition and use of fertilizers (E. S. R., 12, p. 38), nursery fumigation (E. S. R., 12, p. 369), the application of acetylene illumination to country homes (see above), a chemical study of the apple and its products (E. S. R., 12, p. 554), and fungus foes of vegetable fruits (E. S. R., 12, p. 359).

A report on the work and expenditures of the agricultural experiment stations for the year ended June 30, 1899, A. C. TRUE (*U. S. Dept. Agr., Office*

of Experiment Stations Bul. 83, pp. VI+111).—This includes a critical review of the conduct and general management of the stations, with brief abstracts of all station publications received during the fiscal year ended June 30, 1899; and general statistics relative to organization, publications, principal lines of work, revenue, expenditures, etc.

Crop Reporter (*U. S. Dept. Agr., Division of Statistics Crop Reporter, Vol. II, Nos. 4–6, pp. 8 each; Sup., pp. 4*).—These numbers contain statistical data on the condition of crops in the different States and Territories on August 1, September 1, and October 1, 1900, and a number of articles on miscellaneous subjects, including the following: Foreign wheat and rye crops, the introduction of Hungarian and macaroni wheats, supplementary forage crops, protection of birds, the exportation of corn, recent railroad statistics, foreign crops, the contribution of the Department of Agriculture to the material wealth of the country, the United States cotton exhibit at the Paris Exposition, estimated wheat crop of the world, the grain crops of France, exports of cotton from the United States, the growth of the cotton-mill industry in the South, and exports of wheat from Argentina and India. A supplement to No. 4 contains information on the condition of crops abroad at harvest time and on the outlook as to yield and quality in various countries.

Cotton seed and its products (*Tradesman, 44* (*1900*), *No. 8, p. 61*).—The value of cotton seed and its products during the year ended June 30, 1900, is estimated to have been about $42,000,000.

Mineral products of the United States, calendar years 1890 to 1899, D. T. Day (*Chart, Dept. Interior, U. S. Geol. Survey*).—Among other statistics are data showing that the output of phosphate rock in 1899 was 1,515,702 long tons, valued at $5,084,076, as against $1,308,885 tons worth $3,453,460 the previous year. The most valuable output previous to 1899 was 941,368 tons worth $4,136,070 in 1893.

Changes in railroad freight classifications, E. G. Ward (*U. S. Dept. Agr., Division of Statistics Circ. 12, pp. 43*).—This reports the results of an investigation undertaken to determine the effect of the changes in the classification of freight made January 1, 1900, upon the cost of transporting commodities between New York and Chicago.

Papers read at the spring meeting of the Pennsylvania State Board of Agriculture (*Pennsylvania Dept. Agr. Rpt. 1899., pt. 1, pp. 185–259*).—The following subjects were discussed: The soil—its care and culture, the possibilities of Pennsylvania as a fruit-growing State, bacteriology for the farmer, fruit-culture for profit, potato culture, forage crops, successful dairying, feeding and management of dairy cattle, the dairy interests of Pennsylvania, the leaves of plants and their relation to plant diseases, breeding and care of swine, business methods on the farm, the rural school problem, and our country schools.

Farmers' library list, Mira L. Dock (*Pennsylvania Dept. Agr. Bul. 65, pp. 30*).—This gives a list of some 400 books suitable for an agricultural library, with name of publisher and retail price of each.

Agricultural education in English rural schools (*West Indian Bul., 1* (*1900*), *No. 4, pp. 428–444*).—Outline suggestions for teaching agriculture in English rural schools as issued by the board of education in England.

NOTES.

Colorado Station.—B. U. Dye, of Rockyford, has been appointed a member of the governing board of the station to succeed A. L. Kellogg; J. L. Chatfield has been reappointed, and Gov. J. B. Orman succeeds Gov. C. H. Thomas as an ex officio member of the board.

Maryland College and Station.—W. G. Johnson, entomologist of the station and professor of entomology in the college, has resigned to accept a position on the editorial staff of the *American Agriculturist*, with headquarters at New York City. H. P. Gould, assistant entomologist, has been placed temporarily in charge of the work of the department, until the vacancy is provided for by the board of trustees. Farmers' institutes in the State have been more largely attended than ever before, and the interest manifested in the meetings has been very great.

New Hampshire College.—A course in forestry has been established in this college, to extend over one year. It is in charge of F. W. Rane, who now becomes professor of horticulture and forestry. No entrance examination is required, and a certificate will be given after the satisfactory completion of the course.

Virginia Station.—C. W. McCulloch, assistant veterinarian of the station, has resigned, and H. Bannister, D. V. M., of Roanoke, Va., a graduate of the Veterinary College of the University of Pennsylvania, has been appointed in his place.

Utah Station.—John Stewart and B. K. Jones, assistant chemists, resigned their positions January 1, 1901.

Necrology.—Prof. Max von Pettenkofer, renowned for his investigations in medicine, hygiene, and physiology, died by suicide at Munich February 10, 1901, at the age of 82 years. Professor Pettenkofer was born December 3, 1818, at Lichtenheim, Bavaria. He graduated in medicine at Munich in 1843, and three years later became an associate professor in the medical faculty at Munich, being advanced to full professorship in 1853. In the meantime he had succeeded his uncle as director of the court pharmacy at Munich, which under him became in effect a scientific laboratory. Early in his career Professor Pettenkofer became interested in public hygiene, and the results of his studies aroused much popular interest, leading to the establishment of chairs of hygiene at the higher educational institutions in Bavaria. One of his greatest achievements was the study of cholera, and the hygienic and sanitary measures necessary to control the disease and prevent its spread. This work led him to studies of typhus, and in general those diseases in whose dissemination soil, water, and air are important factors. He founded the *Archiv für Hygiene*, and was for a long time coeditor of the *Zeitschrift für Biologie*, both of which have for years been leading periodicals in their lines. To those interested in problems relating to the nutrition of man and animals, Pettenkofer's most interesting investigations had to do with the respiration apparatus. In 1862, a description of his apparatus, designed for experiments with man, was published, and the result of experiments with it appeared at frequent intervals later. The apparatus differed from earlier forms in many important particulars. It was adapted for use in experiments with farm animals by a number of German investigators, while a form suited to experiments with dogs and small animals was devised by Voit, who was long associated with Pettenkofer in this line of research. The results obtained by Pettenkofer and his

associates were of the greatest importance as contributions on the fundamental laws of nutrition and bearing on the details of practical feeding. His labors as a teacher continued until 1894, shortly after the semicentennial of his doctorate was celebrated. At this time his colleagues and scientists in institutions in other countries united to do him honor. It is difficult to overestimate the influence which a man of Pettenkofer's stamp exercises upon students in a half century of active work.

Martin Ewald Wollny, the distinguished agricultural investigator, died at Munich January 8, 1901. He was born at Berlin, March 20, 1846. His studies at the Agricultural Academy of Proskau and the universities of Halle and Leipsic were interspersed with several years of practical experience on farms, and he received the degree of doctor of philosophy from the latter university in 1870. In 1871 he was made professor of agriculture in the Agricultural Academy of Proskau, where he remained 3½ years, being called thence to the professorship of agriculture in the agricultural department of the Munich Technical High School, where he remained until his death. Professor Wollny was one of the first and most prominent of investigators to clearly recognize the importance of the physical properties of soils—moisture, temperature, aeration—in the production of plants, and for 20 years the journal, *Forschungen auf dem Gebiete der Agrikulturphysik*, founded by him, was largely filled with accounts of the researches which he made in this field. He was a prolific writer and contributed extensively to other journals, several of his résumés appearing in the Record. He was also the author of a large number of books and pamphlets, of which the following are the more important: *Der Einfluss der Pflanzendecke und Beschattung auf die physikalischen Eigenschaften und die Fruchtbarkeit des Bodens* (1877), *Ueber die Anwendung der Elektrizität bei der Pflanzenkultur* (1883), *Ueber die Thätigkeit niederer Organismen im Boden* (1883), *Saat und Pflege der landw. Kulturpflanzen* (1885), *Die Kultur der Getreidearten* (1887), *Welche Moorgattungen eignen sich für die Anlegung von Rimpauschen Dammkulturen?* (1890), and *Zersetzung der organischen Stoffe und die Humusbildungen* (1897).

Prof. F. H. Werenskiold, director of the agricultural-chemical control station at Christiania, and a quite prominent contributor to the literature of agricultural investigations in Norway, died suddenly November 13, 1900, at the age of 49 years.

MISCELLANEOUS.—The agricultural council of the Russian Ministry of Agriculture and Imperial Estates has taken steps in the direction of improving the character of the live stock and the live-stock industry in general of that country. At present this industry is said to be far behind that of other countries, the animals kept being inferior and stock raising receiving comparatively small attention from the farmers. The council has recommended the holding of live-stock shows, with prizes for excellence, the establishment of breeding farms and furnishing of expert assistance in purchasing good breeding animals, the maintenance of local breeding establishments where the service of pure-bred animals can be secured, and loans to municipalities and societies for the purpose of purchasing pure-bred animals and providing for their care. In order to carry out the above measures the Ministry of Agriculture, with the concurrence of the Minister of Finance, has recommended an appropriation of 5,000,000 rubles (about $2,000,000) to begin this work and a quadrennial appropriation of 1,125,000 rubles.

Science reports that an anonymous gift of £50,000 has been made to the Woman's Agricultural College at Reading, England.

Prof. T. Pfeiffer, director of the agricultural-chemical laboratory of the University of Jena, has been called to Breslau to succeed Prof. A. Stutzer, who has gone to Konigsberg. Professor Pfeiffer is succeeded at Jena by Dr. Immenhoff, for several years first assistant at the Moor Experiment Station at Bremen.

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EXPERIMENT STATION RECORD.

Editor: E. W. ALLEN, Ph. D., *Assistant Director.*

EDITORIAL DEPARTMENTS.

Chemistry, Dairy Farming, and Dairying—The Editor and H. W. Lawson.
Meteorology, Fertilizers and Soils (including methods of analysis), and Agricultural Engineering—W. H. Beal.
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Entomology and Veterinary Science—E. V. Wilcox, Ph. D.
Horticulture—C. B. Smith.
With the cooperation of the scientific divisions of the Department and the Abstract Committee of the Association of Official Agricultural Chemists.

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EXPERIMENT STATION RECORD.

Vol. XII. No. 8.

The systematic investigation of the soils of Russia was begun over twenty years ago by Prof. V. Dokouchayev, of the University of St. Petersburg, under the auspices of the Imperial Economic Society. This work began with the study of the characteristic soil type known as chernozem, but has been extended, mainly by a system of cooperation between Professor Dokouchayev and his pupils in different parts of Russia, to include all of the principal soil types of European Russia. Prominent among these collaborators is Prof. N. Sibirtzev, of the Agricultural and Forestry Institute of Novo-Alexandria. The work is supported partly by Government institutions and partly by private contributions. The published accounts of these investigations include a hundred or more papers in scientific journals and official reports and documents.

In eastern European Russia an important series of soil investigations has been carried on by Professors Sikorzhinski and Rizpolozhenski, of Kazan University, and their pupils, working independently of Dokouchayev and his associates. This work is supported by the local governments and by agricultural societies. The published accounts of it include over twenty papers, reports, etc.

The development of soil studies in Russia also owes much to the skillful and accurate analytical work done by the late P. Kostichev, of St. Petersburg, as well as to that of Prof. G. Thoms on the soils of the region Riga, who also pursued their investigations independently.

It is with the work of Dokouchayev, however, that scientists are most concerned. He has founded a new school of soil investigation, the fundamental idea of which is the conception of the soil as an independent natural body. With the collaboration of Sibirtzev, this idea has been utilized in the elaboration of a so-called genetic or natural classification of soils, which, in the study of soil formations, requires a differentiation between the parent rock species and the cultivated horizon. His classification differs fundamentally from the petrographic and physico-chemical classifications commonly followed by investigators who have dealt with soils which have been profoundly modified under culture, rather than with those in a largely virgin condition, as in Russia and in the western United States.

The article in this and the succeeding number of the Record, which is based upon a summary by Dr. P. Fireman of an article (in Russian) by Sibirtzev, discusses this classification, and the soil types of Russia. As will be seen, it groups the soils of the world in seven main zones or belts, as follows: (1) Lateritic soils, (2) aeolian or loess soils, (3) soils of the dry steppes, (4) chernozem, (5) gray forest soils, (6) sod or podzol soils, and (7) tundra soils. The grouping is more complete for the northern than for the southern hemisphere, but even in the former it is not claimed that the zones are continuous or uniform. This is but natural, as in some cases certain soil-forming factors within the zones may predominate over the combined action of the other conditions and agencies involved, and thus impart special features which are not distinctive of the prevailing zonal type. Alkali soils, humus calcareous soils, and marsh soils are examples of intrazonal types.

In addition to these zonal and intrazonal soils there is a third class, incomplete or azonal soils, which are composed almost exclusively of unaltered parent rock with little or no fine earth and humus, and which stand on the borderland between true soils and rocks. In this group are classed soils formed *in situ* and alluvial soils. Of course, in nature there must, under any conditions, be many transitional or modified types or forms which are difficult of classification. The subdivision of the various genetic types into groups and subgroups requires, therefore, not only a study of the dynamic forces which impart to the soil its fundamental characteristics, but also a comparative study of the changes in the composition and structure of the soil and of the parent rock, that is, petrographic, physical, and chemical examinations. In this respect the system of Dokouchayev and Sibirtzev harmonizes with the commonly accepted classification of the German and other Russian investigators, including Mayer, Schübler, Knop, Senft, Ramann, Feska, Kostichev, and others.

Turning from a consideration of the system followed to the results accomplished, we find that the work of soil investigation in Russia has been prosecuted with such vigor and thoroughness that not only has Professor Sibirtzev been able to give in a recent report a soil map showing in colors the areas occupied by the principal types of soils of European Russia (about 22), but also a very complete characterization of these soils, including their origin and history, topographic features, vegetation, climatic conditions, relation to moisture, physical and chemical properties, and behavior under culture. An abstract of this report will appear in a future number of the Record. As a comprehensive, systematic, and thorough piece of work which has been fruitful of remarkable results, these Russian soil investigations are worthy of the careful study of all interested in the subject. They should be of especial interest to American investigators, since the soil conditions of Russia are to a considerable extent duplicated on this continent, a

fact which has been recognized by Hilgard and others, particularly in the study of the virgin soils of America.

As bearing on the much discussed question of the merits of variety testing and the difficulty in drawing safe deductions from the results, the work reported from the Woburn Experimental Fruit Farm with strawberries can hardly fail to be of interest. The report is given in abstract in the present number (p. 747) and evidences much skill and pains in conducting the test of 85 varieties of strawberries for 5 successive years. This station is a private institution, and the work was not undertaken on account of any popular clamor for immediate information. The conclusion reached by the authors is that the results "have entirely failed in proving accurately the respective merits of different varieties of strawberries." Plants of the same varieties grown under the same conditions but of different ages furnished data from which entirely different conclusions might be drawn, according to the season selected for the comparison. Likewise, different varieties of the same age grown under precisely the same conditions, so far as could be determined, gave similar irregular variations in different years. In the same season great variations were found to occur owing to minute variations in the position of the plants. "One variety may in one season yield only one-fifth that which it gives in the next, or one-fifth of what it gives in some other position; whereas in the case of another variety the results are entirely reversed and the yield in the next season or in the other position is 5 times greater instead of 5 times less." The writers go so far as to condemn variety testing in general, and maintain that such work will not lead to a better knowledge of the respective merits of varieties than might be gained from general repute or from experienced nurserymen. This, of course, would not apply to new varieties or those untried in the section. While many will not agree with the broad conclusions reached, the results furnish a striking illustration of the discrepancies to be met with in variety testing, and the warning which the article sounds against extensive work of this character is in accord with the views held by many experiment station workers in this country.

RUSSIAN SOIL INVESTIGATIONS.[1]

The systematic study of Russian soils may be said to have begun 22 years ago, when Prof. V. V. Dokouchayev, commissioned by the ancient and renowned "Imperial Free Economic Society," took up the study of the Russian chernozem. Energetic and deeply devoted to his work, he soon gathered around himself a number of gifted and enthusiastic young scientists, who at once attacked various questions relating to soils. Professor Dokouchayev succeeded in organizing in various parts of Russia special soil investigations at the expense of Government institutions and private persons. To Professor Dokouchayev belongs the honor of founding a new school in soil investigations, a school which views the soil as an independent natural body. Among the pupils of Professor Dokouchayev the most celebrated is N. Sibirtzev, the author of the classification of soils, described in this article.[2]

The second place in importance among the Russian soil investigators unquestionably belongs to P. Kostichev, an independent worker. An eminent chemist and agriculturist, he contributed much to the knowledge of soils by his skillful and accurate analyses of soils.

The following statement regarding the classification of soils and the characteristics of Russian soils are taken from the reports of Sibirtzev referred to above.

GENETIC CLASSIFICATION OF SOILS.

The conception of a soil as a natural body having a definite genesis and a distinct nature of its own has led to attempts to create a natural classification of soils on a scientific basis. To this important branch of the study of soils the Russian investigators have made important original contributions, and established new principles for the systematic study of soil formations, not confounding the latter with either rock species or with the cultivated horizon of the ground. The

[1] Translated and condensed from the original articles of N. Sibirtzev, by Dr. Peter Fireman.

[2] Genetic classification of soils, N. Sibirtzev (Zapiski Novo-Alexand. Inst. Selsk. Khoz. Lyesov. Memoirs of the Instit. of Agric. and Forest. at Novo-Alexandria, Government of Lublin, IX (1895), pt. 2, pp. 1–23). Brief survey of the chief soil types of Russia (Ibid., XI (1898), pt. 3, pp. 1–40). The latter memoir was presented in French (Étude des sols de la Russie) to the Seventh International Geological Congress at St. Petersburg, in August, 1897.

scientists of Western Europe have been at a disadvantage regarding this question, since they have for the most part had to deal with soils only slightly developed, shallow or easily washed away, mixed with various geological deposits, and at the same time strongly altered by cultivation. In reality the "tilled layer of the soil" of Western Europe, under the influence of the intensive and deep cultivation there practiced, is an artificial mixture of natural soil and of the underlying primitive rock. This accounts for the geo-petrographic and the physico-chemical classification of soils in vogue among the scientists of Western Europe.

America, with its virgin soils, vast, frequently still untilled plains, prairies, forests, deserts, and barren alkali lands, and clearly defined climatic, physico-geographical and geo-botanical zones offers an excellent field for the study of natural soils. As a matter of fact the American investigators of the soil, especially Hilgard, have already come to a clear recognition of the soil as an independent formation and have established natural soil types.

The study of soils which has been so industriously carried on in Russia the last 20 to 30 years under the leadership of Dokouchayev and Kostichev has for its starting point the idea of the soil as a natural body which occupies an independent place in the series of formations of the earth's crust.

According to the definition of Professor Dokouchayev, under the term "soil" must be understood the surface horizons of the rocks, more or less altered under the simultaneous influence of water, air, and various organisms, living as well as dead. In other words, the soil is the superficial horizon of rocks in which the general processes and phenomena of weathering, transportation of particles, etc., combine with the biological processes and phenomena due to the influence of plants, animals, and micro-organisms. Weathering of rocks which takes place independently of the action of organisms yields products which must be considered as rocks, and the study of such products belongs to petrography. These products may replace and may be converted by cultivation and fertilizing into artificial soils, but must be distinguished from natural soils. However, such soils are of rare occurrence. It is well known that many organisms, such as nitrifying bacteria, lichens, alpine plants, etc., play an important part even in the first stages of the disintegration of the massive and sedimentary rocks. On the other hand, in the class of natural soils should not be included the mechanical deposits of dead organisms or their excretions (peat beds, guano, and the like) and those derived from rocks of organic origin.

As a superficial geo-biological formation of the earth's crust, the soil differs from the parent rock from which it is derived in composition, complexity of the dynamic factors, and external morphological peculiarities. Natural soils vary with (1) the petrographic type of the

parent rock; (2) the nature and intensity of the processes of disintegration, in connection with the local climatic and topographic conditions; (3) the quantity and quality of that complexity of organisms which participate in the formation of the soil and incorporate their remains in it; (4) the nature of the changes to which these remains are subjected in the soil, under the local climatic conditions and physico-chemical properties of the soil medium; (5) the mechanical displacement of the particles of the soil, provided this displacement does not destroy the fundamental properties of the soil, its geo-biological character, and does not remove the soil from the parent rock;[1] and (6) the duration of the processes of soil formation.

All these may be termed genetic conditions of formation of natural soils. Such existing types of natural soils always correspond to a definite combination of the soil-forming factors. The parent rocks, the organisms (with their subsequent transformations), and the physico-geographical conditions of the country, including climate (humidity, temperature), recent geo-physical history and relief, are the chief agents of soil formation. The correlation among these factors may assume various forms, a certain connection or parallelism being observed either among all or only a part of them. Thus, the composition and distribution of the ancient sedimentary and crystalline rocks do not, of course, depend on those conditions (even climatic) of the country to which the formation of the existing soils is subject. But the weathering of the rocks and, in general, all the physical and chemical processes which take place in the soil are influenced by climatic conditions. Climates in which wet and dry seasons alternate produce laterites, the climatic conditions governing the biological processes which result in the formation of lateritic soils. Eolian loess and pulverulent rocks which resemble it are characteristic of continental regions with a dry climate. From this point of view the nature of a given soil type presents, in a certain measure, a function of the climate.

The soils of a given territory are also influenced by the life activities and the dead remains of plant and other organisms. The soils influence the development and the life activity of these organisms and their decomposition after death. On the other hand, the character of the plant growth, for example, plays not only a direct, but an intermediate rôle in the formation of the soil. The relief of the soil has an important influence in determining the drainage, temperature, etc. And lastly, the relative duration of the soil-forming processes which have gone on since the removal of the glacial or water cover, as for example, the successive changes which have taken place in the climate, the encroachments of the forests upon the prairies, the spread of marshes, the drying up of the soil, etc., must in their turn influence the character

[1] Otherwise the soil is converted into alluvium, diluvium, etc., or, in general, into mechanical deposits of secondary formation.

of the soils. The knowledge of the laws and the forms of these influences make it possible to obtain from the study of soils a basis for the reconstitution of the recent past of the country and for sketching its recent geo-physical history. The essential factors determining the characteristics of natural soils are as follows:

(1) The conditions and the factors of the origin of the given soil type (the material and the organic agents); (2) the morphological properties of the soil, *i. e.*, its color, depth, constitution,[1] structure, transition into the parent rock, etc.; (3) the physical, chemical, and chemico-biological properties; (4) the modification with the type; and (5) the geographical and topographical distribution.

The natural classification of soils can be elaborated, taking the genetic principle as a starting point. In establishing the chief groups of soils the existing types of formation of soils in nature must be recognized, the homogeneous or similar combinations of soil-forming agents (such as climate, parent rocks, organisms, relief of country, etc.) must be formulated. As is well known, the weathering of the rocks alone, provided it takes place under similar physico-geographical conditions, may efface to a considerable degree the differences which exist among the rocks, and may give alluvial products of fine earth more closely resembling one another than the original rocks; this similarity is more manifest when the biological factors also tend to produce a uniform result. We can, consequently, establish an ensemble of natural conditions which will produce as a result soils, say, of the chernozem group. A characteristic feature of these soils is the peculiar accumulation of humus under the sod. Wherever analogous conditions prevail soils of the chernozem type are formed. Similarly, we know the climatic conditions which favor atmospheric-eolian weathering, the pulverization of the soft rocks, and where these conditions obtain eolian dust soils result. The soils of these groups in their principal features are the natural resultant of the physico-geographical type of the given continental region or zone. The soil of the different zones will, of course, not be uniform, but will exhibit similarity to the extent to which their content of fine earth and humus reflect the analogous influences of a definite and constant combination of geo-physical factors of soil formation.

In this way the first class of zonal soils is determined. In the proc-

[1] A vertical section of a soil always shows two, three, or even more horizons, detailed descriptions of which are given in Russian works on soils. Of these horizons the most remarkable are: (1) The upper horizon, the most uniformly and strongly colored by humus; (2) the lower horizon, distinguished from the upper by its structure and color and gradually merging into the subsoil; and (3) the subsoil or parent rock preserving its fundamental petrographic features. The first two horizons taken together give the depth of the surface soil. Sometimes in these horizons sub-horizons can be distinguished, with peculiar differences in composition, structure, and tint (alkali soils, forest soils, etc.).

esses of their formation general ectodynamic and special biological phenomena manifest themselves in accordance with the physico-geographical types of continental zones. Such are the following types of soils:[1]

(1) Lateritic soils. These are the soils of the tropical and subtropical regions with alternating wet and dry seasons.

(2) Atmospheric-eolian soils. Formed of the dust rocks in the central regions of the different continents under arid conditions.

(3) Soils of dry steppes or steppes deserts. Being formed of argillaceous and arenaceous primitive rocks, they are chestnut and fawn-colored.

(4) Chernozem soils. These occur in connection with the grass steppes or prairies of the temperate or warm-temperate regions. They develop best from argillaceous rocks.

(5) Soils of wooded steppes and deciduous forests (gray soils), resembling chernozem soils, but differing from them in the conditions of their origin, and in their morphological and other properties.

(6) Sod soils and podzol soils[2] which are peculiar to the temperate-frigid zone. They are typically developed under mixed woods and bushes and are ordinarily accompanied by concretions.

(7) Tundra soils. These are formed from the clays and argillaceous sands of the tundras, in a cold climate with a very long winter. They are characterized, to a greater or less degree, by being perpetually frozen (the subsoil waters are in a solid state).

The groups of soils named represent the soil zones or belts into which the surface of the continents may be divided.

The lateritic soils belong to the coastal zone of tropical and subtropical continental regions which is broken and cut up by seas. After them follow toward the north and south, in the order indicated in the above enumeration, the regions with the other soil types. In the zone of the continental plateaus and the inclosed or partly inclosed plains of the northern hemisphere—in central and southwestern Asia (China Persia, Arabia, Turkestan), in the Caspian region, in northern Africa, and in the western and southwestern States of North America are found the atmospheric-eolian soils and the soils of the steppes deserts. In the southern hemisphere are corresponding zone soils covering central Australia, inland sections of southern Africa (the country of the Hottentots, the region to the south of the sources of the Zambezi

[1] Only the best known types are mentioned here, use being made of the results of studies of the natural soils of Russia, Western Europe, of some regions of Central and Southern Asia, of America, etc., partly of Australia, and Africa.

[2] Podzol soils are unproductive soils consisting mainly of very fine sand, but containing more organic matter than their color would indicate. They resemble ashes in appearance, hence the name "podzol," which indicates this resemblance. They correspond nearly with the Bleisand of Germany.

River), and Argentina. In the open grass plains, such as the Hungarian, Russian, and Siberian steppes or American prairies in the northern hemisphere, and the eastern provinces of Argentina (Entrerios, Corrientes, Buenos-Ayres) in the southern hemisphere, occur the soils of the chernozem group. In Asia, Europe, and North America between the chernozem and tundra soils those of the fifth and sixth group are situated. In the southern hemisphere there is no such complete grouping of soils as in the northern. This is due to a different configuration of the southern continents.

The system of soil zones enumerated above is only an ideal general scheme. In reality no one of these zonal types of soils embraces the continental surface of the globe in a continuous belt. All of them extend in interrupted bands and spots, now expanding enormously in breadth, now becoming narrow, now intermixing with one another at their boundaries, now forming circumscribed areas separated by greater or smaller distances from the principal zones. The reason for this is found in the effect of local orographic, geological, and climatic peculiarities, which interfere with the development or cause a displacement of certain soils.[1]

The division into types distributed in zones or belts does not begin to exhaust the whole variety of natural soils. As stated above, among the soil-forming factors there are some which may individualize themselves by diverging from the concordant action of the other factors. Thus, for example, a particular composition of the parent rock may retain its influence on the soil and thus impart special features which are not proper to the dominant zonal type; a similar effect may be caused by the local saturation of soils with water, due to the configuration of the surface. Humus soils of this second class may be called intrazonal or semizonal. They are dispersed among the main zones in circumscribed areas and spots, occurring chiefly, although not exclusively, in connection with some of the zones. Certain types of the intrazonal soils are met with in those zones whose general conditions favor the most or interfere the least with the action of the individualizing factor.

There are undoubtedly very many types of intrazonal soils. We shall mention the following as examples: (1) Alkali soils, which form when the parent rock contains soluble salts and the drainage is poor. Since the salt contents of the rock may depend on causes purely geological, having no direct connection with the other soil-forming factors, there is, generally speaking, no zonal regularity to be observed in the distribution of alkali soils. However, they occur mostly in the arid regions

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[1] In Russia, *e. g.*, the soils of the steppes deserts extend to the south and southeast of the chernozem, and in North America to the west and southwest (in conformity with the increasing aridity of the climate). It may be added that vertical zones may also be observed on broad slopes and plateaus which appear in a measure as local repetitions of the horizontal zones in an analogous order.

of Europe, Asia, America, Africa, and Australia, *i. e.*, in the second, third, and part of the fourth zones. (2) Humus-calcareous soils. Humus-containing soils are formed from calcareous rocks (limestone, marble, chalk, etc.) accumulating much humus in consequence of the rapid leaching out of the calcium and magnesian carbonates and the retarded decomposition of the organic remains in the feebly alkaline medium. (3) Marshy soils. Under this term are understood soils which owe their origin to the influence of stagnant waters (water-logged soils) dispersed over the surface of continents, wherever the relief and the hydro-geological conditions favor their formation. They occur most frequently in temperate and frigid zones, although sometimes found in the arid zone. They are formed (a) in a medium of fresh water (sour meadows, the marshes of the lowlands), or (b) in sections which are or have been subject to inundations by the sea or by the waters of estuaries (sea marshes, salt marshes, delta marshes, etc.). The different stages in the formation of the swamps, the diverse composition of the organisms, the character of the aqueous medium, the drying up of the marshy basin due to various causes, give to the soils of this type a great variety.

Lastly, there are many natural soils which are composed of the unaltered parent rock (when forming *in situ*) to the almost complete exclusion of fine earth and humus, or which are formed by a mixed process (1) by the mechanical deposition of particles, mineral as well as organic (alluvium); and (2) by the periodic action on the alluvial deposits of the special factors which form humus soils. The soils of this nature stand, so to speak, on the border line between soils proper and rocks, in one case merging into soils, in another approaching rocks. They form the third class of incomplete or azonal soils; they are met with everywhere. When they are formed *in situ*, outside of alluvial depressions and valleys, they can be divided into two large groups, (1) crude soils and (2) skeleton soils. By crude soils are meant those in which there is a considerable quantity of clay-like particles (clays, silt, and fine sand), but in which the horizon of vegetable humus is not clearly defined. Every humus soil passes downward into a crude soil, but the term is applied here only to those soils which are wholly or almost wholly crude. The name skeleton soil is applied to those in which granular and sandy, gravelly, or pebbly elements, or in general, the skeleton mechanical elements which take the place of the humus and fine earth, entirely predominate.

Among the conditions which conduce to the formation of crude and skeleton soils are the following:

(1) Unalterability or difficult alterability of the parent rock or of the rocky components of the soil (sand, rock fragments, pebbles, compact sedimentary rocks, etc.).

(2) The washing off of the humus horizon by the snow and rain waters (crude soils on hills and slopes).

(3) The short duration of the processes of soil formation (undeveloped soils on comparatively recently uncovered or deposited rocks).

(4) The interference with the soil-forming processes by unfavorable climatic influences (especially in deserts and arctic regions).

The fundamental feature of alluvial soils is their formation with the aid of mechanical transportation and deposition of particles by water. Such are the soils of the river valleys. Alluviums, however, must not be confused with alluvial soils. The former are purely mechanical deposits of varying depth—geological formations—while an alluvial soil is the horizon of this deposit which has been subjected to the action of the general dynamic agents of weathering and to the influence of organisms.

To sum up the above considerations, natural soils may be divided into the following genetic classes and types:

Class I.—Zonal soils, complete.
- Type 1. Lateritic.
- 2. Atmospheric eolian.
- 3. Soils of the steppe, deserts or dry steppes.
- 4. Chernozem.
- 5. Soils of wooded steppes and gray forest soils.
- 6. Sod soils and podzol soils.
- 7. Soils of the tundras.

Class II.—Intrazonal soils.
- Type 1. Alkali lands.
- 2. Humus-calcareous soils.
- 3. Marshy soils, etc.

Class III.—Incomplete or azonal soils.
- Soils formed *in situ*.
  - (*a*) Crude } of various groups.
  - (*b*) Skeleton } of various groups.
- Alluvial soils (of different types).

In nature transitional forms are found among the soils of the various genetic types. These transition types may result (1) from the fact that the soil-forming agents (*e. g.*, the climatic conditions) do not change suddenly, but more or less gradually, and thus can produce intermediate results; or (2) from the changes which take place in the soils themselves in the course of their formation and development. Soils may pass through various phases and forms of development in correspondence with the external influences which act upon them. Thus, some alkali soils, losing little by little their salts by leaching, are converted into soils of dry steppes or even into chernozem. Alluvial soils, having passed out of the sphere of river inundations, approach the local zonal types. If a locality, for one reason or another, loses its

drainage, the soils may become swampy, and, *vice versa*, marshy soils, by drying and drainage, lose their characteristic peculiarities and approach other local types. If, during the period of formation of chernozem, the steppe or prairie is encroached upon by forests, the latter change the structure and composition of the soil in the direction of soils of wooded steppes and forest soils, etc.

The genetic types of soils are large categories which include many subtypes, groups, and subgroups. A detailed classification of soils may be based on two kinds of facts: (1) On the degree or force and on the variation of those dynamic processes which impart to the soil the fundamental features of the given genetic type. Thus, for example, there exist conditions which lead to the formation of chernozem soils, but these conditions may vary, may deviate from a certain mean, and, in consequence of these fluctuations, from one and the same or a similar parent rock there may result unlike chernozems with a different content and quality of humus. (2) On the changes in the composition and structure of the soils in connection with the composition and structure of the parent rocks. The subdivisions of this category are based upon (*a*) the physical properties of the soils, *i. e.*, their skeleton and fine earth; (*b*) the chemical and chemico-petrographic peculiarities of the soils. Chernozem, for instance, may be argillaceous, subargillaceous, subarenaceous, marly, phosphoritic, etc. The division of the genetic types and subtypes of soils into groups and subgroups, a division based on the mechanical, physical, and chemical properties of the soil mass, connects the system here described with the common soil classifications of the German and Russian authors (Mayer, Schübler, Knop, Senft, Ramann, Feska, Kostichev, and others). It is believed that a soil classification such as that described above, which is based on the quantitative contents in the soil of skeleton and fine earth and on the particular character of these two constituents (mechanico-physical groups and subgroups), is more general than the commonly accepted system. Following these subdivisions, or, more properly, within them, are the chemical subdivisions based on (1) the chemico-petrographic composition of the soil skeleton, (2) the composition of the siliceous substances of the fine earth of the soil (the chemical nature of the soil clay, of the zeolitic compounds, etc.), and (3) the oxids and salts containing no SiO_2, their quantity and nature (carbonates of alkaline earths, of alkalis, ferrous and ferric oxid, phosphates, sulphates, their solubility in water, etc.).

(Concluded in next number.)

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

Thomas slag and the determination of its phosphoric acid content, A. N. PAPEZ (*Ztschr. Landw. Versuchw. Oesterr., 3 (1900), pp. 695–713; abs. in Chem. Centbl., 1900, II, No. 24, p. 1213*).—The author made comparative tests of methods of determining solubility in citrate solution, citric acid, and formic acid, as well as of determining total phosphoric acid. The results with citrate solution are considered unreliable. Those with citric acid and formic acid solutions were more satisfactory. For preparing the solution for the determination of total phosphoric acid the author recommends boiling 0.5 gm. of the slag with 100 cc. of nitric acid of specific gravity 1.25 for 15 to 20 minutes. The phosphoric acid may be precipitated by means of the ordinary, the Wagner, or the concentrated molybdic solutions. The use of different kinds of magnesia mixture did not affect the results.

The determination of potash by means of phosphomolybdic acid, WAVELET (*Ann. Chim. Analyt. et Appl., 5 (1900), pp. 289–292; abs. in Chem. Centbl., 1900, II, No. 12, p. 689*).—The directions given are as follows: Dissolve 10 gm. of the substance in 200 cc. of water and to 20 cc. of this solution add an excess of the molybdic solution (prepared as described below), evaporate to dryness on the water bath, grind the residue to a powder, add 40 cc. of nitric acid (1 to 10), heat on the water bath, and filter after cooling. Wash the precipitate thoroughly with dilute nitric acid, dissolve in ammonia, and determine phosphoric acid in the solution by means of magnesia mixture in the usual way. Potash is calculated by multiplying the weight of the magnesium pyrophosphate by 0.64.

The potash may also be determined by titrating the ammonium-magnesium phosphate with lead nitrate. For this purpose dissolve the precipitate on the filter in 20 cc. of nitric acid (1 to 20), add phenolphthalein and neutralize with ammonia, add 1 cc. of acetic acid, make the volume to 100 cc., and to 50 cc. of this solution add 5 cc. of 5 per cent sodium acetate solution, and 3.5 per cent lead nitrate solution until a drop of the solution gives a yellow coloration with potassium iodid solution. A blank test is made for correcting the results.

The percentage of potash is calculated by multiplying the corrected number of cubic centimeters of lead nitrate by 1.99.

The phospho-molybdic solution used is prepared by dissolving 140 gm. of sodium carbonate (Na_2CO_3) and 20 gm. of sodium phosphate (Na_2HPO_4) in 500 to 600 cc. of water, adding 70 gm. of freshly ignited molybdic acid (MoO_3), 200 cc. of nitric acid, making the volume to 1 liter, allowing to stand 24 hours, and filtering. This reagent gives with potassium, ammonium, and thallium salts as well as alkaloids, a yellow precipitate soluble in ammonia and insoluble in nitric acid. The molybdenum content of this precipitate varies, but the ratio of potash to phosphoric acid remains constant at 1.99.

A short method for determining potash in potash salts, H. NEUBAUER (*Ztschr. Analyt. Chem., 39 (1900), No. 8, pp. 481–502*).—A method for the estimation of potash in crude salts containing mixtures of sulphates and chlorids of potassium, sodium, magnesium and calcium. To a 25 cc. solution of 0.5 gm. of substance a few drops of hydrochloric acid are added and enough platinic chlorid for precipitating the potash as double chlorid salts. The solution is evaporated to dryness in a water bath, moistened with about 1 cc. of water, and rubbed with a glass rod with a flattened end. About 30 cc. of alcohol are added in successive portions of 10 cc. and the mass rubbed after each addition. The material is covered and allowed to stand half an hour, receiving an occasional rubbing during that time. It is then transferred to a Gooch crucible and washed with ether. The crucible is then gently heated while a current of hydrogen gas is introduced through the lid. After 5 minutes the flame is increased to a dull red heat and continued for 20 minutes. The residue in the crucible is first moistened with cold water, then washed about 15 times with hot water, and finally with a 5 per cent nitric acid solution, without the use of a filter pump, for about 30 minutes. The washing should be thorough in order to remove the salts. After this the residue is washed with hot water, ignited, and weighed. The factor 0.48108 is used for estimating the K_2O.

On cellulose determination, C. COUNCLER (*Chem. Ztg., 24 (1900), No. 35, pp. 368, 369*).—This is a comparison of the Schulze-Henneberg, Müller, and Lange methods, and a modification of the Müller method proposed by the author. In the Müller method the dried substance is extracted with a mixture of strong alcohol and benzol, and then with hot water. The residue is treated with bromin water and then with dilute ammonia, heating nearly to boiling. This treatment with bromin water and ammonia is repeated a number of times until the material is not colored when heated with dilute ammonia. It is then washed with water and with boiling alcohol and dried at 110 to 115° C. While Müller claims that 3 or 4 treatments with bromin and ammonia are sufficient, the author finds that sometimes as many as 20 are

required. He has attempted to shorten the method by previously heating the sample with calcium bisulphite solution (8° Baumé) for 4 to 8 hours at 110 to 140° C. in a sealed tube, and then proceeding as before.

Widely different results were obtained by the 4 different methods, the modified Müller and Lange methods giving the lowest results. The Schulze-Henneberg and Müller methods are both believed to be too complicated and tedious, and the author believes that an exact and simple method for determining cellulose has yet to be devised.

The detection of foreign coloring matters in canned tomatoes, G. HALPHEN (*Jour. Pharm. et Chim., 6. ser., 11 (1900), pp. 169–172; abs. in Analyst, 25 (1900), Aug., p. 206*).—Directions are given for detecting coal-tar colors and cochineal. The desiccated pulp is treated with glacial acetic acid for 10 minutes and the liquid then mixed with twice its volume of 90 per cent alcohol and filtered after 10 minutes' standing. The filtrate is diluted with 10 times its volume of water and tested with a small amount of silk floss, the liquid being boiled for at least 15 minutes. In the presence of coal-tar colors the silk assumes a rose or salmon color.

In testing for cochineal the dried residue is thoroughly mixed with hydrochloric acid and the paste shaken with twice its volume of 90 per cent alcohol. The filtrate is diluted as before and shaken with amyl alcohol. The 2 layers formed are separated with the aid of carbon bisulphid. If cochineal is present the filtrate will have a rose color, and the coloring matter may be extracted with amyl alcohol, forming a yellowish red solution. The latter may be tested with uranium acetate, with which it gives a characteristic green coloration.

Handbook of industrial organic chemistry, S. P. SADTLER (*Philadelphia: J. B. Lippincott Co., 1900, 3. ed., pp. XVIII+543, figs. 126*).—In this edition every chapter has been revised and new matter added, those on natural and artificial dye colors being largely rewritten. Some old and less important matter has been omitted and the bibliographical data and statistics have been brought up to date.

Commercial organic analysis, A. H. ALLEN (*Philadelphia: P. Blakiston's Son & Co., 1900, vol. 3, pt. 1, pp. XVI+589*).—This is a revision and enlargement by J. Merritt Matthews, and treats of tannins, dyes and coloring matters, and writing inks.

The oil chemist's handbook, E. HOPKINS (*New York: John Wiley & Sons, 1900, pp. VIII+72*).

Synoptic tables for the analysis of fertilizers and soil amendments, P. GOUPIL (*Tableaux synoptiques pour l'analyse des engrais et des amendements. Paris: J. B. Baillière & fils, 1900, pp. 80, figs. 3*).—These tables give concise directions for the preparation of reagents carrying out the determinations and calculating the results in the analysis of the ordinary fertilizing materials and amendments, including fertilizing chemicals, guano, dried blood, horn, meat, solid and liquid manure, poudrette, vinasse, sewage, lime, limestone, marl, and gypsum.

The preparation of an exact standard acid, G. L. HIGGINS (*Jour. Soc. Chem. Ind., 19 (1900), No. 11, pp. 958–962, figs. 2*).—The method and apparatus used in the preparation of a standard acid from gaseous hydrochloric acid are described.

The determination of potash by means of phospho-molybdic acid (*Ann.*

Chim. Analyt. et Appl., 5 (*1900*), *pp. 345–347*).—A letter to the editor by von Garola calling attention, in connection with Wavelet's article noted above (p. 713), to Raulin's work on the same subject.[1]

The electrolysis of copper sulphate as a basis for acidimetry, C. A. Kohn (*Jour. Soc. Chem. Ind.*, *19* (*1900*), *No. 11*, *p. 962*).—Tests of this method of preparing a standard acid are reported.

Estimation of nitrites in the presence of nitrates, H. Pellet (*Ann. Chim. Analyt. et Appl.*, *5* (*1900*), *p. 361; abs. in Chem. Ztg.*, *24* (*1900*), *No. 92*, *Repert.*, *p. 339*).—This method depends upon the fact that nitrites in the presence of ferrous salts and acetic acid are broken up, while nitrates are not affected. The total nitrogen of the nitrites and nitrates is determined by treatment with ammonium-ferrous sulphate and hydrochloric acid, and measuring the nitric oxid. The nitrites are then determined in a second sample by treatment with ammonium-ferrous sulphate and acetic acid. Or both nitrites and nitrates may be determined in the same sample by first treating with the iron salt and acetic acid, and after reading off the volume of gas, adding hydrochloric acid to decompose the nitrates.

Estimation of nitrites with nitrates, L. de Koninck (*Ann. Chim. Analyt. et Appl.*, *5* (*1900*), *p. 365; abs. in Chem. Ztg.*, *24* (*1900*), *No. 92*, *Repert.*, *p. 339*).—In order to determine the nitrates with nitrites, by the method of Pellet, as noted above, the author finds that 30 to 40 cc. of fuming hydrochloric acid should be added. With this precaution the method was found accurate.

Contribution to the determination of the oxidizable substances in water, E. Ruppin (*Ztschr. Untersuch. Nahr. u. Genussmtl.*, *3* (*1900*), *pp. 676–681; abs. in Chem. Centbl.*, *1900*, *II*, *No. 20*, *p. 1088*).

The determination of air in water, H. Pellet (*Ann. Chim. Analyt. et Appl.*, *5* (*1900*), *pp. 369, 370; abs. in Chem. Centbl.*, *1900*, *II*, *No. 20*, *p. 1089*, *fig. 1*).

The analysis of sour milk, F. J. Lloyd (*Jour. British Dairy Farmers' Assoc.*, *15* (*1900*), *pt. 2*, *pp. 98–105*).—By means of a number of series of experiments the author shows the decrease in the total solids of milk after souring. The result corrected by adding one-third of the percentage of lactic acid to the total solids was approximately accurate. This was true for milk 48 hours or 5 weeks old. When the samples contained other than lactic acid micro-organisms, the rule did not apply. The author recommends sterilizing reserve samples of milk to overcome the difficulty and prevent any injustice on a revision of the analysis.

Nicotin in tobacco, G. d'Utra (*Bol. Agr. São Paulo*, *1. ser.*, *1900*, *No. 3*, *pp. 138–152*).—Determinations of nicotin in samples of a large number of different kinds of tobacco are reported and discussed, and the agricultural applications of nicotin (tobacco extracts) are explained.

On the presence of invertin and sucrose in grapes, V. Martinand (*Compt. Rend. Acad. Sci. Paris*, *131* (*1900*), *No. 20*, *pp. 808–810*).

The estimation of free sulphuric acid in wines, F. Carpentieri (*Staz. Sper. Agr. Ital.*, *33* (*1900*), *pp. 307–340*).

The estimation of the dry matter in wine by a specific gravity method, F. Carpentieri (*Staz. Sper. Agr. Ital.*, *33* (*1900*), *pp. 341–356*).

The adulteration of olive oils, W. K. Ferrein (*Farmazeft*, *7* (*1900*), *p. 1007; abs. in Chem. Ztg.*, *24* (*1900*), *No. 92*, *Repert.*, *p. 339*).—The substances used in adulterating olive oil are given and the methods of determining the amounts of the adulterants.

On the simultaneous occurrence of saccharose and gentianose in the fresh roots of gentian, E. Bourquelot and H. Hérissey (*Compt. Rend. Acad. Sci. Paris*, *131* (*1900*), *No. 19*, *pp. 750–752*).

Production of nitric acid from air by means of the electric flame, A.

[1] Compt. Rend. Acad. Sci. Paris, 110 (1890), p. 289.

McDougall and F. Howles (*Mem. Manchester Lit. and Phil. Soc., 44* (*1900*), *pt. 4, No. 13, pp. 1–19; abs. in Jour. Chem. Soc.* [*London*], *78* (*1900*), *No. 456, II, p. 651*).—Reports tests of the influence of different forms of combustion chamber, strength of current, mixtures of oxygen and nitrogen, and temperature upon the rate of formation of nitric acid.

On the simultaneous production of two nitrogen salts in the crater of Vesuvius, R. V. Matteucci (*Compt. Rend. Acad. Sci. Paris, 131* (*1900*), *No. 23, pp. 963–965*).

Miscellaneous analyses, H. J. Wheeler (*Rhode Island Sta. Rpt. 1899, pp. 146–151*).—Analyses are reported of salt, sodium carbonate, double carbonate of potash and magnesia, muriate of potash, sulphate of potash, carbonate of potash, acid phosphate, floats, Thomas slag, aluminum phosphate, waste liquor from rendering works, nitrate of potash, nitrate of soda, sulphate of ammonia, dried blood, cotton-seed meal, and soot.

On an improved Geissler potash apparatus, J. Wetzel (*Ber. Deut. Chem. Gesell., 33* (*1900*), *No. 18, pp. 3393, 3394, fig. 1*).—The improvement consists of the introduction of small movable glass funnels into the absorption bulbs, which collect and hold the gas bubbles for some time beneath the surface of the potash solution, thus insuring more complete absorption.

BOTANY.

Xenia, or the immediate effect of pollen, in maize, H. J. Webber (*U. S. Dept. Agr., Division of Vegetable Physiology and Pathology Bul. 22, pp. 44, pls. 4*).—The author reviews much of the more recent literature on the supposed immediate or direct effect of pollen on the character of seeds and fruits, and gives in detail the records of a number of experiments and results in crossing different varieties and races of corn. The results obtained are discussed at considerable length, and it is shown that in the experiments, particularly in the case of dent races with a starchy endosperm crossed with sweet corn with a sugary endosperm, there was no indication of modification of the chemical constitution. It seems probable that in a great majority of cases the results confirm Correns's proposition, viz, that the influence of foreign pollen exhibits itself only in the endosperm, all parts which are outside of this remaining entirely uninfluenced, and that the influence extends only to the color of the endosperm and the chemical composition of the reserve materials—the starch or dextrin therein. In all cases the size and form of the kernels remain unchanged. The experiments and observations of the author favor the theory that xenia in maize is caused by fecundation of the embryo sac nucleus by one of the male nuclei, as suggested by De Vries and Correns; and the evidence now available seems to indicate that those cases of supposed xenia where the pericarp is influenced must be due to other causes or explained as errors of observation.

On the poisonous properties of compounds of sodium, potassium, and ammonium, H. Coupin (*Rev. Gén. Bot., 12* (*1900*), *No. 137, pp. 177–193*).—A report is given on the toxic equivalent of the principal compounds of sodium, potassium, and ammonium in regard

to young plantlets of wheat when grown in distilled water. The toxic equivalent is the minimum weight of the substance dissolved in 100 parts of distilled water which will kill the plant. The figures given in the accompanying table are the average of a large number of experiments, and show the relative poisonous properties of the substances named. The more common of the substances experimented with are given in the following table:

Amount of different substances required to kill wheat plantlets in water cultures.

Substance.	Per cent.	Substance.	Per cent.
Sodium chlorid	1.8	Sodium chromate	0.125
Potassium chlorid	1.9	Potassium chromate	.0625
Ammonium chlorid	1.6	Ammonium chromate	.0625
Sodium bromid	1.2	Sodium bichromate	.0064
Potassium bromid	.1	Potassium bichromate	.03125
Ammonium bromid	1	Ammonium bichromate	.025
Sodium iodid	.05	Sodium sulphate	.8
Potassium iodid	.05	Potassium sulphate	2.3
Ammonium iodid	.33	Ammonium sulphate	2.5
Sodium fluorid	.14	Sodium phosphate	1.5
Potassium fluorid	.09	Potassium phosphate	6
Ammonium fluorid	.04	Ammonium phosphate	.4
Sodium nitrate	1.7	Sodium carbonate	1.1
Potassium nitrate	3	Potassium carbonate	1.7
Ammonium nitrate	3.9	Ammonium carbonate	.3
Sodium oxalate (neutral)	.125	Sodium chlorate	.058
Potassium oxalate (neutral)	.25	Potassium chlorate	.2
Ammonium oxalate (neutral)	.125		

Effect of chemical media on the growth of fungi, L. PLANCHON (*Ann. Sci. Nat. Bot., 8. ser., 11 (1900), pp. 1–248, pls. 4, figs. 63; abs. in Jour. Roy. Micros. Soc. [London], 1900, No. 4, p. 496*).—The results of a large number of experiments on the growth of 20 species of Dematieæ in a number of different nutrient fluids and chemical solutions are given. The terms fumagoid, alternarioid, macrosporoid, etc., are noted to denote the different growth forms in the various species. The best culture medium was found to be potato acidified by lying for a quarter of an hour in 1 per cent sulphuric acid. It is found that plants of this class are more subject to morphological diversity, depending on the chemical composition of the medium, than are the Mucedineæ. These modifications affect the vegetative change more than the reproductive organs and are believed to be a mode of defense against desiccation and the injurious effects of the medium. The most common forms of such modifications are the thickening and encysting of the cell wall, a change in the form of the filament itself, the production of chlamydospores of isolated cells capable of germinating, or of toruloid forms in which the mycelial filament has entirely disappeared. All kinds of transitional forms between the extremes were noted. The author, as a result of his investigations, regards *Dematium pullulans* and *Cladosporium herbarum* as distinct species. Two new species of Altenaria are described, *A. varians* and *A. polymorpha*.

The nodule organism of the Leguminosæ, R. G. SMITH (*Centbl. Bakt. u. Par., 2. Abt., 6 (1900), No. 11, pp. 371, 372*).—A brief note is given of the investigations of the author on the organisms producing tubercles on the roots of Leguminosæ. The organisms were grown in a number of media, and the author states that the appearance of these organisms depends very largely upon the medium and upon the method which is employed in preparing them for observation.

As a result of his observations, he claims that these organisms are true yeasts, and accounts for their different forms by the differences produced by medium and fixation. The motile character of the organism has been mentioned by a number of investigators, but apparently no one has been able to discover the flagellum. By using undiluted, young peptone-glucose cultures, fixing in formalin and staining with Coerner-Fischer stain, the author was able to discern adhering to the capsule an exceedingly thin terminal flagellum about 2 μ long, bearing upon the distal end a tuft. The observation of the delicate filament is aided by the presence of this terminal tuft.

Attempts were made to prove the fixation of nitrogen with pure cultures in artificial media, but without success. In his investigations *Bacillus megatherium* was found to accompany the tubercle organism very frequently, and fixation experiments were tried with it without success.

Agricultural botany, J. PERCIVAL (*New York: Henry Holt & Co., 1900, pp. XII+798, figs. 265*).—This work on botany by the professor of botany of the Southeastern Agricultural College, Wye, England, is designed to meet the necessities of agricultural students. Much of the material found in the ordinary text-books is omitted and the matter arranged so as to not only cover the essentials of the science, but is applied to the crops of the farm, orchard, and garden. General morphology and physiology are treated at considerable length, the illustrations being drawn as far as possible from the well-known plants of the field and garden. Laboratory exercises are provided, in which the subjects for study are all drawn from common plants, the object being to secure familiarity with the structure and functions of the plants with which the agricultural student is most familiar. The classification and special botany of the principal farm crops of England are quite fully given, the material being grouped by natural orders. The botanical characteristics of the plants are described, their cultural varieties discussed, and notes given on their cultivation, handling, and uses. Under the Gramineæ special chapters are, in a similar manner, devoted to the true grasses, to cereals—in which oats, barley, rye, and wheat are considered—to the common grasses of the farm, and to the subject of grasses and clovers for temporary and permanent pastures. Special studies are also given of the weeds of the farm, farm seeds, fungi as related to farm crops, and bacteria as related to farm life, in every case the practical considerations being kept in the foreground.

Botany—an elementary text-book, L. H. BAILEY (*New York: The Macmillan Co., 1900, pp. XIV+355, figs. 502*).—This book is intended for the elementary student and in popular, though exact, language describes the nature of the plant, its relations with its surroundings, the minute structure of plants, and studies of the kinds of plants. The histological studies given are only those required for a proper understanding of the primary functions and actions of plants. The author does not believe in the extensive use of the compound microscope by the elementary student,

and has arranged the studies so as to secure familiarity with the things of everyday life. A feature of the work is its illustrations, which are nearly all new and well chosen to illustrate their respective topics.

The plant covering of Ocracoke Island, T. H. KEARNEY (*U. S. Dept. Agr., Division of Botany, Contributions from the U. S. National Herbarium, vol. 5, No. 5, pp. 261-319, figs. 18*).—An ecological study is given of the North Carolina strand vegetation as shown upon Ocracoke Island. The climate and physiography of the island and geology of its soils are described, together with the plant formations as exhibited in the strand flora, salt-marsh vegetation, pasture, and cultivated plants. The ecological forms and adaptations to environment of the different plants are discussed, and the anatomy of some of the more important species of the strand flora is figured and described.

Geographical distribution of the species of Cuscuta in North America, ALIDA M. CUNNINGHAM (*Proc. Indiana Acad. Sci., 1898, pp. 214, 215*).—Notes are given on the geographical distribution of the dodders into the different life zones as defined by Dr. C. H. Merriam, of this Department.

The absorption of water by decorticated stems, G. E. RIPLEY (*Proc. Indiana Acad. Sci., 1898, pp. 169-174*).—A number of experiments are reported in which the ability to take up water by stems which had had their cortex removed was compared with those in which the wood had been cut out, and both compared with normal stems. The experiments showed that the woody tissue is the principal path for the passage of water through stems, and the removing of the cortex delayed the wilting of the stems for some hours beyond that in which it took place in normal stems.

Transformations of organic substances during germination, G. ANDRÉ (*Compt. Rend. Acad. Sci. Paris, 130 (1900), No. 11, pp. 728-730*).—From experiments, made chiefly on Phaseolus, it is concluded that the regeneration of insoluble albuminoids takes place at the expense both of asparagin and of the nitrogen of the amid acids. This is said to take place concurrently with the absorption of phosphoric acid by the plant. Starch and cellulose decrease progressively from germination until the time when the weight of the plant is greater than that of the seed, while the amount of cellulose not saccharized by dilute acids continually increases, this being due in a large degree to the transformation of starch.

FERMENTATION—BACTERIOLOGY.

Tobacco bacteria, C. J. KONING (*Indische Mercuur, 1899, July 8; abs. in Jour. Roy. Micros. Soc. [London], 1900, No. 4, p. 501*).—According to investigations conducted by the author, *Diplococcus tabaci* and *Bacillus tabaci I* play an important part in the fermentation of tobacco. *B. tabaci I* is motionless, aerobic, and varies much in size in artificial cultures. It does not stain by Gramm's method nor form spores. It is killed in 20 minutes at 60° C. and in 5 hours at 50°. Peculiar yeast-like appearances were observed in agar cultures some weeks old but on transference to fresh media normal growth returned. Asparagin is decomposed with the formation of ammonia, nitrates are reduced to nitrites, glucose consumed, and gelatin liquefied. On naturally acid tobacco extract the bacillus does not grow well, doing better when the acidity is diminished. *Diplococcus tabaci* forms small round yellow colonies on gelatin plates, grows best at room temperatures, and forms ammonia from asparagin. It is an essential aerobe and grows well on acid media. Gelatin is slowly and feebly liquefied by it.

Other bacteria were observed which are believed to have a share in raising the fermentation temperature and also connected with the fermentative processes.

Formation and structure of bacterial spores, MÜHLSCHLEGEL (*Centbl. Bakt. u. Par., 2. Abt., 6 (1900), Nos. 3, pp. 65–71; 4, pp. 97–108*). Spore formation is said to be usually preceded by the appearance of globules in the protoplasm, after which toward one pole there appears a gray speck having approximately the same size as the future spore when the globules disappear. Spore formation is apparently brought about under the incentive of a nucleus, by the combination of the globules with the interstitial plasma. This may be demonstrated by staining reagents. The structural differentiation of the spore proceeds from within outward, ending in the formation of a membrane composed of 2 layers, the endosporium and the ectosporium. The difficulties frequently experienced in staining spores is said to be due in great measure to the resistance of the spore plasma and in a lesser degree to the membrane. The endosporium is stained with difficulty and may allow pigments to permeate it without its becoming affected. The endosporium is converted into the sheath of the young rod and the ectosporium is cast off during germination.

Studies in systematic bacteriology, F. D. CHESTER (*Delaware Sta. Rpt. 1899, pp. 34–52*).—The author has devoted considerable time in perfecting a method of bacterial investigation and in devising a scheme for bacterial description. The result of his labor is given in the report. The outline he proposes for the study of systematic bacteriology follows very closely the Migula system with few modifications. A number of terms are proposed and defined which the author thinks will prove useful in descriptive bacteriology. A proposed synopsis is given of the groups of bacteria, in which the groups of the genera Bacterium, Bacillus, Pseudomonas, Microspira, and Mycobacterium are distinguished.

Descriptions of certain species of bacteria isolated from cultivated soil, F. D. CHESTER (*Delaware Sta. Rpt. 1899, pp. 52–75, pls. 2*).—Descriptions of a number of soil bacteria are given, the following being described as new: *Bacterium fermentationis, B. radiatum, B. ambiguum, Bacillus delavariensis, B. soli, and Microspira tenuis.*

A key to species of bacteria, L. HEIM (*Abs. in Ztschr. Angew. Mikros., 6 (1900), No. 7, pp. 188–191*).—Brief keys are given for the recognition of the more common species of Streptococcus, Micrococcus, Sarcina, Bacterium, Bacillus, and Spirillum.

Bacteria, A. RAMSEY (*Sci. Roll, 1 (1900), No. 1, pp. 1–32*).—A general bibliography of bacteriological literature is given. The topics are arranged chronologically and the entries in the present number cease with 1875.

Bacteria as friends and foes of the higher plants, T. M. FRIES (*Svenska Trädgårdsför. Tidskr., 1900, Nos. 1, pp. 3–6; 2, pp. 20–25*).

On the structure of bacteria, FEINBERG (*Anat. Anzeiger, 17 (1900), No. 12–14, pp. 225–237, pls. 5*).—From studies of the bacilli of anthrax, tuberculosis, swine plague, and of other organisms, the author concludes that bacteria possess a differentiated plasma and nuclear structure.

Researches on nitrifying organisms, E. DEMOUSSY (*Ann. Agron., 26 (1900), No. 6, pp. 295–316*).—Résumés are given of the following articles which appeared in *Arch. Sci. Biol. Russe* during 1899: On the culture of the nitrifying organisms of

the soil, by Oméliansky; The influence of organic substances on the activity of nitrifying microbes, by S. Winogradsky and V. Omeliansky; The influence of free carbon dioxid on nitrification, by Godlewski; and Nitrification of organic nitrogen, by V. Omeliansky, with comments on some of the articles by the abstractor.

Concerning the flagellæ, reserve material, nucleus, and spore formation of bacteria, A. MEYER (*Flora, 86 (1900), pp. 428–468, pl. 1; abs. in Centbl. Bakt. u. Par., 2. Abt., 6 (1900), No. 10, pp. 339–341*).

Do anaërobic organisms require oxygen? M. W. BEIJERINCK (*Arch. Neerland., 2. ser., 2 (1899), p. 397; abs. in Centbl. Bakt. u. Par., 2. Abt., 6 (1900), No. 10, p. 341*).—The author states that obligate anaërobes as well as facultative ones require a small quantity of free oxygen for their maintenance.

A contribution to the knowledge of thermophilous bacteria, G. MICHAELIS (*Arch. Hyg., 36 (1899), p. 285; abs. in Centbl. Bakt. u. Par., 2. Abt., 6 (1900), No. 5, p. 154*).—Four species of thermophilous bacteria were isolated from spring water whose optimum temperature for growth was between 50 and 60° C., with 57° the average. No growth takes place below 37° C. The organisms are spore forming, 2 to 4 μ in length. Their reaction toward various media, etc., are described.

Oxalic acid formation by bacteria, W. ZOPF (*Ber. Deut. Bot. Gesell., 18 (1900), No. 1, pp. 32–34, fig. 1*).—The author reports the formation of oxalic acid from grape sugar in cultures of *Bacillus aceti*, *B. acetigenum*, *B. acetosum*, *B. ascendens*, *B. kützingianum*, *B. pasteurianum* and *B. xylinum*. These bacteria were grown in a nutrient media containing 10 per cent gelatin, 1 per cent peptone, 1 per cent meat extract, with from 2 to 3 per cent grape sugar. Similar experiments were conducted with the same organisms in which the grape sugar was omitted from the nutrient solution and no oxalic acid was formed.

The physiology of Bacillus prodigiosus, G. RITTER (*Centbl. Bakt. u. Par., 2. Abt., 6 (1900), No. 7, pp. 206–209*).—A contribution to the knowledge of *B. prodigiosus* in which the behavior of the organisms in a number of media is described.

Bacterial studies in sugar manufacture, O. LAXA (*Centbl. Bakt. u. Par., 2. Abt., 6 (1900), No. 9, pp. 286–295*).

The fermentation of cellulose, V. OMELIANSKY (*Arch. Sci. Biol. [St. Petersburg], 7 (1899), No. 5, pp. 411–434*).

Are bacteria the cause of tobacco fermentation? O. LOEW (*Centbl. Bakt. u. Par., 2. Abt., 6 (1900), No. 4, pp. 108–112*).—A controversial article in which the author maintains that tobacco fermentation is not bacterial.

Enzyms, J. GRÜSS (*Festsch. Schwendener, Berlin, 1899, pp. 184–201, pl. 1; abs. in Jour. Roy. Micros. Soc. [London], 1900, No. 2, p. 223*).—Notes are given on some of the properties of the enzym of *Penicillium glaucum*. This enzym is said to possess the power of energetically splitting up cane sugar, but has a less powerful action on starch and reserve cellulose and has none of the properties of oxidase. Malt, on the other hand, has the action of γ-oxidase. It acts energetically on starch, less so on cane sugar, and very slightly on reserve cellulose.

A proteolytic enzym in germinating seeds, V. HARLAY (*Compt. Rend. Acad. Sci. Paris, 131 (1900), No. 16, pp. 623–626*).—The presence of a proteolytic ferment in fungi has been previously noted by Bourquelot and Hérissey (E. S. R., 10, p. 929). In the present paper the author gives a report of experiments made with germinating lentils, in which he found a proteolytic ferment analogous to trypsin. It is believed that such a ferment will be found in all germinating seeds. The ferment found in the lentil seeds seems to be identical with that reported above in the fungi.

An enzym causing cleavage of protein in germinating barley, W. WINDISCH and B. SCHELLHORN (*Wchnschr. Brau., 17 (1900), No. 24, pp. 334–336*).

A proteolytic diastase of malt, A. FERNBACH and L. HUBERT (*Compt. Rend. Acad. Sci. Paris, 130 (1900), No. 26, pp. 1783–1785*).—An account is given of the

isolation of a proteolytic diastase from barley malt, and some of its properties are described.

The influence of phosphates and other mineral substances on the proteolytic diastase of malt, A. FERNBACH and L. HUBERT (*Compt. Rend. Acad. Sci. Paris, 131 (1900), No. 4, pp. 293–295*).

METEOROLOGY.

Atmospheric radiation, F. W. VERY (*U. S. Dept. Agr., Weather Bureau Bul. G, pp. 134, figs. 22*).—This paper gives the results of investigations carried on during the past 8 years to determine the law of radiation as dependent upon pressure or density of the air. The apparatus and methods used are described in detail, and the results of studies of the influence of various conditions upon radiation are reported.

"The results of the present research prove that within moderate depths of only a few meters the radiation of dry air, purified from carbon dioxid, increases quite uniformly with the depth; that the radiation of a 1-meter layer of purified air at 50° C. and near atmospheric pressure (735 mm.), as compared with one at 0° C., is 0.00068 radim, representing a transformation and transfer of thermal energy of 0.00068 small calories every second through each square centimeter of limiting surface; that the radiation of a like depth of carbon dioxid at the same temperature is three and one-half times that of air, or 0.00238 radim, which is very nearly a maximum for this temperature, further increase of the radiant depth being unattended by a corresponding addition of radiant energy, showing that equilibrium between radiation and emission has been almost reached at this depth; that the radiation from a layer of steam 5 ft. deep at one-sixth of atmospheric pressure is two and one-half times that from a like body of dry air at temperatures near the boiling point of water, and eight-tenths of the radiant emission from the black solid body; while for smaller depths the radiant power of water vapor is relatively greater, a steam jet of small dimensions radiating over four times as strongly as one of air, a ratio which would doubtless have been considerably greater if the air had been perfectly dry.

"There appears to be no reason to doubt that the radiation of a moderate depth of homogeneous air at a given temperature depends on the product of the depth by the density, and remains the same when depth and density vary inversely; but the absorption of a given mass of aqueous vapor has been found to be smaller when distributed through a large volume of air than when concentrated. The phenomena are conditioned by molecular relations. Reciprocal variation of depth and density does not change the number of molecules which are engaged in the radiant transaction in a homogeneous medium; but dilution by another substance involves a partition of energy among molecules whose radiant and absorbent properties are dissimilar.

"As an absorbent of terrestrial radiation aqueous vapor is very much more efficient than any other atmospheric ingredient; but as radiators when in large masses, the substances which compose the atmosphere do not differ as widely as might be supposed, and the position of chief radiant may be assumed in turn by either aqueous vapor, carbon dioxid, or the permanent gases, according as the depths and temperatures of the emissive and absorbent layers change. The depth of gas which gives maximum radiation at short range is an insignificant quantity compared with atmospheric dimensions, and radiation from either the atmosphere of the earth or the solar chromosphere is a superficial phenomenon, even when the masses of heated gas measure thousands of miles in thickness. The fineness of the chromospheric lines in the solar spectrum, although the shifts of the Fraunhofer lines indicate pressures of

many atmospheres at the base of the chromosphere, is a sufficient demonstration that only the outer layers radiate. If the emission proceeded also from the depths of the chromospheric mass, the lines of hydrogen and some other elements would be greatly widened; and if the earth's atmosphere radiated unimpeded throughout its depth, its thermal changes and its radiant effects would be enormous. Instead of this, we find the atmosphere playing the part of a conservator of thermal energy, and must gratefully admire the beneficent arrangement which permits the earth to be clothed with verdure and abundant life."

On solar changes of temperature and variations in rainfall in the region surrounding the Indian Ocean. N. and W. J. S. LOCKYER (*Nature, 63 (1900), Nos. 1622, pp. 107–109; 1623, pp. 128–133, figs. 3; Proc. Roy. Soc. [London], 67 (1901), No. 440, pp. 409–431, figs. 3*).—A study of the chemical origin of spectrum lines most evidenced in sun spots at the maxima and minima periods and of the rainfall of India, Mauritius, and other regions is reported. The conclusion is reached "that there is a considerable rise above the mean temperature of the sun around the year of sun-spot maximum and a considerable fall around the year of sun-spot minimum." An analysis of the data relating to rainfall in India during the southwest monsoon and in Mauritius showed that the largest amount of rain fell in India at sun-spot maximum and in Mauritius at sun-spot minimum, although the maximum rainfall in Mauritius generally gave rise to a secondary maximum in India, which therefore "has two pulses of rainfall, one near the maximum and the other near the minimum of the sun-spot period." All famines in India during the last 50 years and all periods between 1849 and 1878, when the Nile was lowest, occurred in the intervals between these two "pulses".

Report of the meteorologist, W. H. BISHOP (*Delaware Sta. Rpt. 1899, pp. 180–193*).—Monthly summaries of observations at 6 different places in Delaware on temperature, pressure, precipitation, relative humidity, and prevailing winds during the year ended June 30, 1899, and a summary of observations on temperature and precipitation during the calendar year 1898 are given.

The summary for 1898 is as follows:

Annual summary of meterological observations in Delaware, 1898.

Locality.	Temperature.			Total rainfall.	No. days on which 0.01 in. or more of rain fell.
	Highest.	Lowest.	Mean.		
	Deg. F.	*Deg. F.*	*Deg. F.*	*Inches.*	
Newark	98 (July)	0.4 (Feb.)	52.9	50.62	103
Middletown	102 (July)	5 (Feb.)	54	51.02	97
Dover	99 (July)	6 (Feb.)	54.3	42.20	98
Milford	99 (July)	10 (Feb.)	56.8	42.06	93
Seaford	98 (July)	11 (Feb.)	55.5	43.84	95
Millsboro	98.5 (July)	6 (Dec.)	54.7	48.50	119

Report of the meteorologist, N. HELME (*Rhode Island Sta. Rpt. 1899, pp. 199–209*).—This includes general notes on the weather and a

tabulated record of observations at Kingston on temperature, precipitation, cloudiness, and prevailing winds during each of the first six months of 1899, with a summary for the period from January 1, 1890, to June 30, 1899, inclusive. The summary for 6 months of 1899 (January 1 to June 30, inclusive) is as follows:

Temperature (degrees F.).—Maximum, 95, June 6; minimum, —10, February 10; highest monthly mean, 67.4, June; lowest monthly mean, 23.5, February; highest daily mean, 80, June 6; lowest daily mean, - 1.5, February 10; range for six months 105. *Precipitation* (inches).—Total (rain and melted snow), 26.79; greatest monthly, 9.67, March; least monthly, 1.87, June; greatest in 24 consecutive hours, 2.76, March 19; snow fall—total, 34.25; greatest monthly, 24.5, February; least monthly, 0.5, April. *Weather*.—Number of clear days, 77; number of fair days, 44; number of cloudy days, 60; number of days on which there was precipitation of 0.01 in. or more, 59. *Prevailing wind*, southwest.

The rainfall in May was the smallest recorded at Kingston during the 11 years that records have been kept.

On the study of distant storms by means of the electroradiophone, T. Tommasina (*Compt. Rend. Acad. Sci. Paris, 131 (1900), No. 22, pp. 876–878*).

Seasonal variations in temperature at various altitudes in the free atmosphere, L. Teisserenc de Bort (*Compt. Rend. Acad. Sci. Paris, 131 (1900), No. 22, pp. 920–922, fig. 1*).—The results of observations on temperature in different seasons of the year by means of balloons are charted and discussed. These show that there is a very marked seasonal variation in temperature up to an altitude of 10,000 meters, the variation diminishing as the height increases.

On the gaseous projectiles of cannon proposed for the prevention of the formation of hail, G. Gastine and V. Vermorel (*Compt. Rend. Acad. Sci. Paris, 131 (1900), No. 19, pp. 766–768*).—Various forms are discussed, those producing annular motions of the air when discharged being considered most effective.

Temperature at the experimental farm at Wollonbar, New South Wales (*Rpt. Under Sect. Mines and Agr., New South Wales, 1899, pp. 39, 40*).—A tabular statement of maximum and minimum temperatures, rainfall, and number of cloudy and dry days during each month of 1899.

Meteorological observations at Hawkesbury Agricultural College, Richmond, New South Wales (*Rpt. Under Sect. Mines and Agr., New South Wales, 1899, p. 15*).—A tabular record is given of the rainfall and highest, lowest, and mean temperatures during each month of the years 1893 to 1899; evaporation for each month of 1898 and 1899; and velocity of the wind during parts of 1898 and 1899.

Actinometric measurements in the Pamirs, B. W. Stankewitch (*Compt. Rend. Acad. Sci. Paris, 131 (1900), No. 22, pp. 879, 880*).

WATER—SOILS.

Third report of work in the study of the fertility of soils, S. Bogdanov (*Selsk. Khoz. i Lyesor., 198 (1900), July, pp. 59–112; Aug., pp. 241–288*).—This is a continuation of previous work (E. S. R., 11, p. 130). The author elaborated some years ago a method of determining the fertility of a soil on the basis of a simplified chemical analysis. The method has been put to repeated tests in the course of several years and proved reliable in every instance. The chief features

of the method are as follows: The soil containing a medium amount of moisture is placed in a thermostat for 48 hours at 30° C., and nitrogen in the form of ammonia and nitric acid is determined. The results thus obtained are assumed to indicate the amount of nitrogen assimilable by oats (the cereal with which the author chiefly experimented). The phosphoric acid is then determined in a solution obtained by digesting the soil for 24 hours with a 2 per cent solution of acetic acid, using the soil and solution in the ratio of 1:4. This gives the available phosphoric acid. All other assimilable substances are determined by analyzing an aqueous solution obtained by shaking for 48 hours 1 part of the soil with 100 parts of water. The results thus obtained serve as a guide in determining the fertilizer needs of a soil. Culture experiments made on the basis of such results corroborated the correctness of the judgment based on them. In the present report, which covers the years 1898 and 1899, experiments are described which were instituted to subject the author's method to further tests. Many new soils from various localities in Russia were studied. Not only oats, but also barley, millet, peas, flax, buckwheat, mustard, and sugar beets were grown. In all cases the kind of fertilizer required was reliably indicated by the chemical analysis.

The results of numerous culture experiments to determine the easily assimilable substances in soils of different degrees of fertility carried out during several years are reported. A yield of oats on 2 kg. of soil of less than 2 gm. of dry grain and 6 to 7 gm. of dry crop above the ground is considered low; 3 to 4 gm. of dry grain and 6 to 12 gm. of dry crop above ground, medium; over 4 gm. of dry grain and over 12 gm. of dry crop above the ground, high. The following table gives the mean of the author's figures for easily assimilable fertilizing constituents in the soil corresponding to different yields of oats and also Hellriegel's figures for nitrogen:

Assimilable plant food in the soil corresponding with different yields of oats.

	Author's data.			Hellriegel's figures for nitrogen.
	Potash.	Phosphoric acid.	Nitrogen.	
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Low yield	0.001	0.001	0.003	0.002
Medium yield	.002	.002	.007	.005
High yield	.003	.003	.011	.008

Experiments with barley were more limited than with oats. The author concludes, however, that the nitrogen content of the soil corresponding to a medium yield of barley is 0.0051 to 0.0083 per cent. Hellriegel's figure is 0.0042 to 0.0070 per cent.

Experiments with sugar beets gave the following results:

Assimilable plant food in the soil corresponding with different yields of sugar beets.

	Nitrogen.	Phosphoric acid.
	Per cent.	*Per cent.*
High yield	0.0140	....
Medium yield	.0069	0.0026
Low yield	....	.0008

Experiments with white mustard showed that, while it resembles oats and barley with respect to assimilating nitrogen and phosphoric acid from the soil, it is strikingly sensitive to the sulphuric acid content of the soil. Other things being equal, the yield was increased 1½ to 2 times when a fertilizer containing sulphuric acid was added.

From his own results and from those of Hellriegel, the author has prepared the following table, which indicates the contents of easily assimilable substances in the soil in the cases of low, medium, and high yields of oats and other plants which do not differ strikingly from one another in their plant-food requirements:

Assimilable plant food in the soil[1] corresponding with different yields of oats and plants of similar requirements.

	Nitrogen.	Phosphoric acid.	Potash.
	Per cent.	*Per cent.*	*Per cent.*
High yield	0.0108	0.0050	0.0060
Medium yield	.0060	.0022	.0020
Low yield	.0021	.0010	.0010

—P. FIREMAN.

The amount of humus in soils and the percentage of nitrogen in the humus as affected by applications of air-slaked lime and certain other substances, H. J. Wheeler, C. L. Sargent, and B. L. Hartwell (*Rhode Island Sta. Rpt. 1899, pp. 152–159*).—This is an account of studies of the changes in humus and nitrogen content of soil which had been used in pot experiments with corn, oats, and rye during 1893, 1894, and 1895. Humus was determined by treatment with hydrochloric acid according to Hilgard, followed by extraction with ammonia according to Huston and McBride's method.

"The nitrogen in the humus was determined by using a 2½ per cent solution of potassium hydroxid in place of the solution of ammonium hydroxid of like strength, which was employed in the determination of humus. Aliquot portions of the extract were then neutralized with sulphuric acid, and after evaporating to dryness in a Kjeldahl flask, the nitrogen was determined as usual by the method of Kjeldahl. The soils were air-dried before analyzing, and the different samples contained from 2.00 to 2.75 per cent of water determined at 100° C."

[1] Calculated to dry matter.

At the beginning of the pot experiments with the soil used in this investigation muriate of potash was applied at the rate of 7.36 gm. and dissolved boneblack at the rate of 22.07 gm. per pot in every case. These amounts were afterwards increased to 10 and 25 gm. respectively. In different cases ammonium sulphate and nitrate of soda were applied in amounts furnishing 2.65 gm. of nitrogen per pot. Where lime was used the maximum amount applied was 147.2 gm. per pot (4 tons per acre). Gypsum was also applied in some cases at rates furnishing the same amount of calcium oxid as the lime. The results of the determinations of humus and nitrogen are given in the following table:

The influence of lime and other substances on the humus and nitrogen content of soils.

Fertilization.	Humus nitrogen in dry soil.	Humus in dry soil.	Nitrogen in dry humus.
	Per cent.	*Per cent.*	*Per cent.*
Unmanured	0.130	3.86	3.37
Ammonium sulphate	.128	3.93	3.26
Ammonium sulphate, air-slaked lime (1 ton per acre)	.133	3.77	3.53
Ammonium sulphate, air-slaked lime (4 tons per acre)	.126	3.63	3.47
Ammonium sulphate, calcium sulphate (land plaster) at rate equivalent in CaO to 4 tons of air-slaked lime per acre	.139	3.65	3.81
Without nitrogen and lime	.129	3.75	3.44
Air-slaked lime (4 tons per acre)	.139	3.51	3.68
Nitrate of soda	.143	3.93	3.64
Nitrate of soda and air-slaked lime (4 tons per acre)	.133	3.42	3.89

"From the foregoing it will be seen that without exception the addition of air-slaked lime or gypsum resulted in lowering the total amount of humus, as compared with the unmanured plat, yet in every instance the percentage of nitrogen in the humus had been increased. In fact, the latter statement applies also even where no nitrogen was added.

"Where lime was not applied, but nitrogen was employed in form of sulphate of ammonia, which in the acid soil proved poisonous to plants, it will be observed that the percentage of nitrogen in the humus was even less than where no manure was used. On the contrary, where nitrogen in the form of nitrate of soda was added without lime, the percentage of nitrogen in the humus was greater than in the case of the unmanured soil.

"It is also of special interest to observe that in the case of the unlimed soil which received potash and phosphoric acid but no nitrogen, the percentage of humus became less than in the unmanured soil; while, on the contrary, where nitrogen was applied as nitrate of soda and as sulphate of ammonia to unlimed soil, it is possible that a slight increase in the percentage of humus resulted. The differences are not great enough, however, to furnish any positive evidence in this respect."

The causes and the importance of the decomposition of nitrates in soils, W. Krüger and W. Schneidewind (*Landw. Jahrb., 29 (1900), No. 4–5, pp. 747–770, pls. 2*).—In continuation of previous investigations, the authors report pot experiments to determine the action of various kinds of carbonaceous materials and the effect of well-rotted and fresh mixtures of manure and litter on the activity of the denitrifying organisms, as well as field experiments on denitrification, comparing the results by the 2 methods, and discussing the influ-

ence of the previous handling of the manure on its subsequent behavior in the soil.

Of the various carbonaceous substances tested (pentosans and crude fiber from wheat straw, cotton, straw, peat, and pentosans from peat) the first was most active in promoting denitrification and decreasing the yield.

The application of sterile fresh manure resulted in no increase of yield, while well-rotted manure produced a decided increase. In the field experiments, also, it was found that the use of fresh manure resulted in a decided decomposition or transformation of the nitrogenous compounds of nitrate of soda or of urine. On the plats receiving applications of a mixture of solid and liquid cow manure with straw there was a yield of 825 lbs. less of dry matter and 61.36 lbs. less of nitrogen than on the plats receiving only liquid manure (urine). While the results of the field experiments agree in this case with those of the pot experiments in showing that there is an important decomposition or transformation of nitrates under certain conditions of manuring, it is not considered safe to make too close an application of the results of pot experiments in field practice.

The chemical functions of certain soil bacteria, F. D. CHESTER (*Delaware Sta. Rpt. 1899, pp. 76–85, figs. 3*).—This article records observations on the production of ammonia and the reduction of nitrates to nitrites by soil bacteria and on the relation of the growth of these organisms to the reaction of the media.

The apparatus used in studying the production of ammonia in neutral bouillon and for determining the amount of ammonia produced are described. The following table gives the amounts of ammonia in milligrams per 100 cc. of culture produced by the different organisms studied during 7, 14, and 30 days' growth at room temperature:

Ammonia found in cultures of soil organisms in neutral bouillon.

Name of species.	Amount per 100 cc. of culture.		
	7 days.	14 days.	30 days.
	Mg.	*Mg.*	*Mg.*
Bacterium mycoides	9.18	20.06	45.50
Bacillus subtilis	6.46	18.35	46.20
Bacillus pulvinatus:			
Var. A	1.02	10.20	....
Var. B	0	5.78	18.30
Bacillus 6	0.30	5.44	22.00
Bacillus 7	2.40	19.72	38.10
Microspira tenuis	0	0	0
Bacterium fermentationis	0.30	8.50	27.90

The bouillon used in these cultures contained 1.11 per cent of organic matter and 0.18 per cent of nitrogen. "The largest quantities of ammonia produced after 30 days' growth was for *Bacterium mycoides* and *Bacillus subtilis*, 45.5 and 46.2 mg. per 100 cc. respectively. In

other words, only about two-tenths of the total nitrogen in the medium was converted into ammonia."

The ammonia produced was determined by distilling with calcined magnesia. It was found that the uninoculated bouillon gave 3.4 mg. of ammonia per 100 cc. by this treatment, and consequently this correction was made in the results obtained with the different cultures.

To determine the effect of an abundant supply of air upon the denitrifying action of soil bacteria *Bacillus pulvinatus* was grown in peptone solution containing 0.1 gm. of nitrate of soda per liter in a flask abundantly supplied with purified sterile air and also in a flask without aeration. "At the end of 5 days 7 mg. of nitrite of soda per 100 cc. were found in the aerated culture and 30 mg. in the nonaerated. At the end of 10 days 20 mg. of nitrite of soda were found in the aerated and 40 mg. in the nonaerated culture."

The denitrifying action of a number of soil organisms was studied. The various organisms were grown in a neutral 1 per cent Witte peptone broth containing 0.1 gm. of nitrate of soda per liter, in Erlenmeyer flasks plugged with cotton wool and kept at room temperatures. Nitrite was determined by the Griess colorimetric method. The results were as follows:

Nitrite in cultures of soil bacteria.

Name of species.	Amount of nitrite of soda in 100 cc. of culture.				
	5 days' growth.	10 days' growth.	15 days' growth.	30 days' growth.	Nitrates in culture at end of 30 days; tested with diphenylamine.
	Mg.	*Mg.*	*Mg.*	*Mg.*	*Mg.*
Bacterium mycoides	0.4	0	0	0	0
Bacillus subtilis	5.0	0	0	0	0
Bacillus pulvinatus:					
Var. A	1.5	10.0	10.0	1.0	0
Var. B	10.0	10.0	10.0	7.0	Trace.
Bacillus 6	0	0	0	0	0
Bacillus 7	2.0	Trace.	Trace.	0	0
Microspira tenuis	10.0	10.0	0	0	0
Bacterium fermentationis:					
Var. A	5.0	2.0	2.5	1.0	0
Var. B	10.0	7.0	7.0	5.0	Trace.

The organisms studied were found to grow best in neutral or slightly alkaline media. In media containing carbohydrates the organisms produced considerable amounts of acid, including acetic, formic, propionic, butyric, and lactic acids. "All soils containing larger or smaller quantities of vegetable matter are liberally supplied with carbohydrates in one form or another, hence all soils have a tendency to become acid as a result of the development of soil microbes."

The following table shows the amounts of free acid stated in the number of cubic centimeters of tenth-normal sodium hydroxid re-

quired to neutralize 100 cc. of the culture produced by various soil organisms during different periods of growth.

Free acid in cultures of different soil organisms stated in cubic centimeters of tenth-normal sodium hydroxid required to neutralize 100 cc. of the cultures.

Name of species.	In 2 per cent glucose bouillon; 5 days' growth; direct titration for free acid.	In 2 per cent peptone broth, with an excess of chalk; 4 weeks' growth; by distillation.	In 4 per cent glucose bouillon, with an excess of chalk; 4 weeks' growth; by distillation.	In 2 per cent glucose bouillon; 5 days' growth; direct titration for free acid.
	Cc.	*Cc.*	*Cc.*	*Cc.*
Bacterium mycoides	6.20	6.32		12.0
Bacillus subtilis	15.20	9.80		12.0
Bacillus pulvinatus	2.80	19.30	15.2 16.0 13.0 11.8	11.0
Bacterium fermentationis			8.2 12.1 22.5	20.0
Bacillus delavariensis			17.0	12.0
Bacterium radiatum			4.0	5.0
Bacterium ambiguum			0	0
Bacillus soli			0	0
Microspira tenuis			0	0

Composition of the air at various altitudes, G. Hinrichs (*Compt. Rend. Acad. Sci. Paris, 131 (1900), pp. 442, 443; abs. in Jour. Chem. Soc. [London], 78 (1900), No. 456, II, p. 649*).—Reports calculations of the proportions of carbon dioxid, oxygen, argon, nitrogen, and hydrogen at different altitudes.

The regeneration of confined air by means of sodium dioxid, G. F. Jaubert (*Compt. Rend. Acad. Sci. Paris, 131 (1900), No. 18, pp. 715, 716*).—This is a brief note referring to the proposition of Desgrez and Balthazard (see below) to use sodium dioxid to purify air vitiated by respiration, and calling attention to the work of the author on this subject during the past 3 years. The principal objection urged to the use of sodium dioxid for this purpose is its high price.

The regeneration of confined air by means of sodium dioxid, Desgrez and Balthazard (*Compt. Rend. Acad. Sci. Paris, 131 (1900), No. 20, p. 812*).—A reply to the above referring to previous communications[1] and denying Jaubert's claim to priority.

Well waters—a study, A. McGill (*Trans. Ottawa Lit. and Sci. Soc., 1899–1900, No. 2, pp. 133–148, figs. 4*).—This article discusses the origin and movement of ground water, the origin and sources of contamination of well waters, and means of detecting and preventing such contamination.

On the presence of oxysulphocarbonates of iron in the water of the Rhone, H. Causse (*Compt. Rend. Acad. Sci. Paris, 131 (1900), No. 23, pp. 947–949*).

Underground temperature at Oxford in the year 1899 as determined by five platinum resistance thermometers, A. A. Rambant (*Proc. Roy. Soc. [London], 67 (1900), No. 437, pp. 218–222*).—Observations with thermometers of the Callendar and Griffiths[2] pattern at depths of $6\frac{1}{2}$ in., 1 ft. 6 in., 3 ft. $6\frac{1}{2}$ in., 5 ft. $8\frac{1}{2}$ in., and 9 ft. $11\frac{1}{2}$ in. are very briefly reported and discussed and the method of standardizing the apparatus is described. A comparison is made of the calculated and observed results which seem to indicate a high degree of precision in the observations.

[1] Compt. Rend. Acad. Sci. Paris, 128 (1899), pp. 361–363; 131 (1900), No. 7, pp. 429–431.

[2] Nature, 53 (1895), pp. 39–46, figs. 4.

Humus in soils, G. D'UTRA (*Bol. Agr. São Paulo, 1. ser., 1900, No. 3, pp. 152–160*).—Analyses of 146 samples of soil from different parts of São Paulo, Brazil, showing moisture, organic matter, phosphoric acid, lime, potash, nitrogen, and humus are reported and discussed. The humus varied from 0.024 to 3.11 per cent, the nitrogen from 0.002 to 0.38 per cent, potash from 0.01 to 0.59 per cent, phosphoric acid from trace to 0.36 per cent, and lime from trace to 0.80 per cent. The soils are generally deficient in humus. The percentage of nitrogen in humus showed wide variations.

On certain conditions affecting the nitrification of soils, J. NEISH (*Jour. Jamaica Agr. Soc., 4 (1900), No. 11, pp. 645–651*).—A popular discussion of this subject, emphasizing particularly the importance of thorough tillage as a direct means of promoting nitrification.

Further observations upon the need of lime in Rhode Island soils, H. J. WHEELER and G. E. ADAMS (*Rhode Island Sta. Rpt. 1899, pp. 160–162*).—A brief account is given of 4 cooperative experiments on grasses conducted for the purpose of further studying the lime requirements of Rhode Island soils. "The results obtained in 1899 fully corroborate those of previous years (E. S. R., 11, p. 918), and together they indicate that a need of lime is quite general in Rhode Island soils."

Preliminary analytical studies of the soils of the Province of Bari, Italy, G. D'ADDIEGO (*Staz. Sper. Agr. Ital., 33 (1900), No. 1, pp. 19–44*).—This article includes a classification of the soils of this province, descriptions of samples analyzed and of analytical methods employed, chemical analyses of 9 samples, and general conclusions and practical applications of the results.

Soil exhaustion, G. E. STONE (*Massachusetts State Bd. Agr. Bul. 6, pp. 29–36, figs. 3*).—Notes are given on some of the causes of soil exhaustion in Massachusetts, and suggestions are made for its restoration.

The future of desert countries, A. SOULEYRE (*Rev. Sci. Paris, 4. ser., 14 (1900), Nos. 18, pp. 545–560, figs. 3; 22, pp. 681–688; 24, pp. 743–749*).

The weathering and erosion of north and south slopes, G. CULBERTSON (*Proc. Indiana Acad. Sci., 1899, pp. 167–170, fig. 1*).—Examinations of the slopes of a number of ravines indicate a decided variation in the rate of weathering when the valleys trend from east and west to southeast and northwest approximately, but little difference where the valleys trend approximately north and south. The differences are doubtless due to greater expansion and contraction, and alternate thawing and freezing on the slopes with southern exposure.

The physical geography of the region of the great bend of the Wabash, W. A. MCBETH (*Proc. Indiana Acad. Sci., 1899, pp. 157–161, figs. 3, map 1*).—Discusses the glacial action in this area.

Studies on the formation of loess, TUTKOWSKI (*Scottish Geogr. Mag., 16 (1900), No. 3, pp. 171–174; abs. in Bul. Soc. Belge Geol., 14 (1900), No. 3, p. 180*).—This is a discussion, based on geological and soil studies in Russia, of Richthofen's theory of the formation of loess during interglacial or post-glacial periods. The author advances the theory that the formation of loess soils is due to the desiccating and transporting action of the foehn. He considers as normal loess soils only those which are found in European Russia, North America, and China. The formation of the so-called loess of France and Belgium he believes to be due to other agencies.

Iowa geological survey, S. CALVIN and H. F. BAIN (*Ann. Rpt. Iowa Geol. Survey, 10 (1899), pp. 666, pls. 11, figs. 102, maps 10*).—This contains, besides administrative reports, papers on Statistics of mineral production of Iowa in 1899, by S. W. Beyer; The succession of fossil faunas in the Kinderhook beds of Burlington, Iowa, by S. Weller; Geology of Lyon and Sioux counties, by F. A. Wilder; The flora of Lyon County, by B. Shimek; Geology of Osceola and Dickinson counties, by T. H. MacBride; Geology of Hardin County, by S. W. Beyer; Geology of Worth County, by I. A. Williams; Geology of Dubuque County, by S. Calvin and H. F. Bain; and

Forestry notes for Dubuque County, by T. H. MacBride. The articles on the geology of the different counties deal with location, previous geological work, physiography, stratigraphy, and economic geology, including mineral products, water supply, and soils. Special attention is given to the loess and glacial drift soils of the Pleistocene deposits of the different counties.

FERTILIZERS.

On the question of the preservation of manure and urine, J. König (*Vrtljschr. Bayer. Landw. Raths., 5 (1900), Sup. No. 3, pp. 500–510*).—The author briefly reviews the work of other investigators on this subject and reports observations on the losses of nitrogen in form of ammonia from solutions of ammonia, ammonium carbonate, ammonium sulphate, and urine with and without access of air, and with and without addition of phenol. The conclusion is reached that the main precaution to be observed in preserving manure from loss of nitrogen is to exclude the air. Unless the air is excluded, preservative materials are of little value. The following practical rule, which is shown to rest on a scientific basis, is given: Protect the manure and urine from air, sun, and rain, and apply in well-rotted condition to soils kept open and well aerated by marling or liming.

The method of making manure-preservation experiments, T. Pfeiffer, F. Moszeik, and O. Lemmermann (*Landw. Vers. Stat., 54 (1900), No. 5–6, pp. 349–378*).—The errors incident to such experiments and means of overcoming them are discussed, the methods used by the authors are described, and a series of experiments are reported.

The contradictory results often obtained in laboratory experiments on the preservation of manure are ascribed to the use of inaccurate or dissimilar methods. Moreover, the results obtained in such experiments can not be applied in practice without danger of serious error. The authors have undertaken to devise a system of investigation which reduces as far as possible the sources of error and makes the results of more scientific and practical value. As a check on the determinations of nitrogen at different stages they recommend the determination of the income in food and outgo in excrement and animal product of the nitrogen, phosphoric acid, and potash. The study of the losses of nitrogen must begin in the stall. Contradictory results have frequently been due to variations in the amount of the easily and difficultly decomposable nitrogen compounds. The difficulties pointed out by Holdefleiss (E. S. R., 11, p. 32) regarding the taking of samples, correction for uneaten food, etc., may be overcome by the use of the balance of nitrogen and mineral matter referred to above. As Maercker has shown, the preservation experiments should always be accompanied by fertilizer experiments.

Experiments with 8 cows in two 14-day series are reported. In one series the manure remained under the animals 8 days, in the other only

24 hours, the manure for each series being kept separate. The liquid excrement was weighed and examined daily. The precautions observed in the sampling of the feed and litter; the construction of the stalls, manure heaps, and liquid manure pits; the weighing and sampling of the solid and liquid manure; the determination of the milk production and increase in live weight; and the analytical methods used are described. The balance for the first and second periods gave a loss of 8.3 per cent of nitrogen, a gain of 2.7 per cent of phosphoric acid, and no change in the amount of potash. The balance for the heaps of mixed solid and liquid manure (after an average of 107 days) showed a loss of 19.1 per cent of nitrogen, and an increase of 3.6 per cent of phosphoric acid and 0.8 per cent of potash. The results obtained indicate the reliability of the methods used, but investigations with a view to their improvement are to be continued.

Denitrification and the action of barnyard manure, T. Pfeiffer and O. Lemmermann (*Landw. Vers. Stat., 54 (1900), No. 5-6, pp. 386-462*).—From the results of an extended series of experiments in pots and on plats in continuation of those previously reported (E. S. R., 11, p. 134) the following conclusions are drawn: The utilization of the nitrogen supply of the soil is unfavorably influenced both by an increase of organic matter and of denitrifying organisms. By the addition of barnyard manure denitrification is promoted, both by the organic matter and by the bacteria, which are thus supplied to the soil. The injurious effects noted in pots during the first season disappear during the second. An increase of organic matter by the addition of a solution of calcium citrate, as well as the use of a pure culture of denitrifying organisms, resulted in the evolution of free nitrogen. The loss of nitrogen in the free state as a result of the application of barnyard manure in pot experiments is considered of only secondary importance in comparison with other factors influencing the utilization of nitrogen by the crop. The utilization of applications of nitrate of soda on light, sandy soils is seriously interfered with by applications of cattle or horse manure at rates of 800 metric centners per hectare (17.81 tons per acre). Since the same manure gives very different results in pots and on plats, the authors caution against the direct application of the results of pot experiments with manure in actual practice. The variable action of the nitrogen of manure can not be explained by ordinary analyses, in which the contents of ammoniacal, amid, and digestible proteid nitrogen are determined. It is claimed that the variable action of different kinds of manure is explained by variations in the extent of denitrification. In the authors' experiments no relation was found to exist between the content of nitrogen-free organic substances, particularly pentosans, and the action of the nitrogen. There is wide difference in the ease and rapidity with which the nitrogen compounds of different kinds of manure undergo decomposition, and in the authors' opinion this is one

of the main causes of the variations in the action of the nitrogen. When the conditions in the preparation of the manure are such as to result in the removal of a large part of the nitrogen-free organic matter, the transformation of the nitrogen into forms which are readily assimilable by plants is almost entirely prevented. Neither ammonia nor elementary nitrogen is formed, and even amids are formed from proteid nitrogen to a very limited extent. An important after-effect of the nitrogen of manure was noted. A part of the nitrate nitrogen, in case of applications of manure, is fixed, and may result in a direct increase in the utilization of nitrogen or may exert an after-effect in increasing the yield of the succeeding crop. The theory of Gerlach that there are certain kinds of manure which produce more nitrates than they destroy, and thus do not cause a loss of the nitrogen of nitrates used in connection with the manure, is not substantiated by the authors' experiments.

The fifth year's observations upon the effectiveness of nitrate of potash, as compared with like amounts of nitrogen and potash in form of muriate of potash and nitrate of soda, H. J. WHEELER and J. A. TILLINGHAST (*Rhode Island Sta. Rpt. 1899, pp. 174–176*).—The experiments of previous years (E. S. R., 11, p. 914) on this subject were continued during 1899. The results obtained are briefly summarized in this article.

"The data for the 5 years since this experiment was begun show as yet no striking differences between the results with nitrate of potash and those secured with like quantities of nitrogen and potash as nitrate of soda and muriate of potash. It is evident, therefore, that with the amounts of nitrogen and potash employed neither the chlorin nor the soda has as yet proved of positive advantage either as a direct or indirect manure. Incidentally, the experiment has shown the inferiority of gypsum (land plaster) as a source of lime for a sour soil, as compared with air-slaked lime."

Observations upon the growth of plants on an acid upland soil, limed and unlimed, H. J. WHEELER and J. A. TILLINGHAST (*Rhode Island Sta. Bul. 69, pp. 177–204, figs. 7*).—This is an account of a continuation during 1899 of observations which were begun in 1893 (E. S. R., 11, p. 915). During this period nearly 200 different kinds of plants have been tested. No lime has been applied since 1894. The kinds and amounts of other fertilizers used in 1899 were the same as in the previous year. Data for growth and yield of crops on the different plats are reported in detail. The principal results may be summarized as follows:

Plants benefited by liming.—Orange quince, black Tartarian cherry, early Richmond cherry, Burbank Japan plum, American linden, American elm, rhubarb, Australian saltbush, hemp, asparagus, red raspberry (Cuthbert), red and white currants, barley, oats, spring wheat, mangel-wurzels, chicory, onions, English turnips, sweet peas, balsams, and poppy.

Plants not benefited by liming.—Norway spruce, cranberry, cowpea, and flax.

Plants giving inconclusive results with liming.—Concord grapes, blackberry, raspberry (Ohio Blackcap), spring rye, serradella, and carrots.

Of the plants tested the following were more benefited by nitrate of soda than by sulphate of ammonia: Rhubarb (on limed plats), Australian saltbush, hemp, asparagus, currants, serradella, mangel-wurzels, onions, English turnips, sweet peas, balsams, and poppy. The plants on which sulphate of ammonia proved superior to nitrate of soda were blackberry, raspberry, cowpea, chicory, and flax.

"As a result of the observations thus far made here, it may be said of wheat, as of barley, oats, and rye, that no regularly recurring advantage of nitrogen in nitrate of soda, as compared with nitrogen in sulphate of ammonia, has been observed." In case of carrots results were inconclusive.

Investigations on losses from manure heaps by soaking into the soil beneath, P. Rippert (*Fühling's Landw. Ztg., 49 (1900), No. 22, pp. 829–835, fig. 1*).—Examinations of the soil under manure pits lined in various ways and unlined showed the presence of large amounts of nitrogen compounds which had leached from the manure. There were also present large numbers of various kinds of organisms which transform nitrogen compounds and facilitate their escape in the drainage. The construction of pits which will not be subject to such losses is discussed.

Examination of soil to different depths underneath manure heaps, A. Emmerling and H. Wehnert (*Landw. Wchnbl. Schleswig-Holstein, 49 (1899), No. 49, pp. 904–908*).—Investigations similar to those noted above, except that no study was made of the organisms present.

The fertilizer and phosphate industry, L. P. Brown (*Tradesman, 44 (1901), No. 9, pp. 92–97*).—It is estimated that there is at least $100,000,000 invested in the United States in plants confining themselves strictly to the manufacture of artificial fertilizers.

"When to this are added the large sums invested in phosphate mines in Florida, Tennessee, and South Carolina, in pyrite mines in Virginia and Vermont, and in the plants for recovering animal ammoniates at packing houses in Chicago, Kansas City, Omaha, etc., in the cotton-seed oil mills, and in independent sulphuric acid plants, selling their products mainly to manufacturers of fertilizers, it would seem that $300,000,000 would be a low estimate at which to put the total American investment in the fertilizer and kindred industries."

The article discusses the sources of nitrogen, phosphoric acid, and potash, the manufacture of sulphuric acid, the phosphate mining industry, and the present status and outlook of the fertilizer industry.

Phosphate rock, E. W. Parker (*Tradesman, 44 (1901), No. 9, p. 81*).—In an extended article on the development of the mineral resources of the Southern States the author gives some statistics of the phosphate industry. These show that while a little phosphate rock was mined in North Carolina in 1899, practically the entire product came from Florida, Tennessee, and South Carolina in the order named. The total production of these States in 1899 was 726,420 long tons, valued at $2,804,061; 430,192 tons, valued at $1,192,916; and 356,650 tons, valued at $1,078,099, respectively. "South Carolina, which now ranks third, was the only State producing phosphate rock in 1880, at which time the output amounted to 190,763 long

tons, valued at $1,001,556. Mining began in Florida in 1889, and in 1890, 45,501 long tons, valued at $338,190, were produced. The discovery of phosphate rock in Tennessee was made in 1893, but actual mining did not begin until the following year, when 19,188 long tons were produced."

Report on the phosphate deposits of Egypt (*Geological Survey of Egypt. Cairo: National Printing Dept., 1900, pp. 27, maps 3*).—Descriptions, with analyses, are given of phosphate deposits in 3 localities, namely, in the peninsula of Sinai, lower Egypt, and Dakhla Oasis. The deposits are said to be very extensive. The analyses reported show that the proportion of tricalcium phosphate varies from 12.94 to 60.97 per cent. The phosphates are not suited to the manufacture of superphosphates.

On the application of lime upon a sour soil before and after seeding to grass, H. J. Wheeler and J. A. Tillinghast (*Rhode Island Sta. Rpt. 1899, pp. 171–173*).—A brief account is given of plat experiments at the station during 1898 and 1899, which "illustrates in the most striking manner that in seeding sour (acid) land to timothy, lime should be thoroughly worked into the soil before the seed is sown. A top-dressing of lime applied subsequently to seeding, while it may prove somewhat helpful, exerts but little benefit in connection with timothy as compared with lime harrowed into the soil."

Analyses of commercial fertilizers, H. J. Wheeler, B. L. Hartwell, et al. (*Rhode Island Sta. Bul. 70, pp. 11*).—Analyses and valuations of 55 samples of fertilizers are reported.

Fertilizer inspection, C. D. Woods and J. M. Bartlett (*Maine Sta. Bul. 66, pp. 117–132*).—A previous bulletin (E. S. R., 12, p. 324) reported analyses of most of the samples of fertilizers furnished by manufacturers as required by the State law. The present bulletin contains analyses of 157 samples of fertilizers collected on the open market by agents of the station and also of manufacturers' samples received after the previous bulletin was issued. Attention is called to the fact that 70 brands of fertilizers offered for sale in the State "carried, in the case of at least one of the ingredients, a different statement on the bag from the certified statement filed with the station. . . . In about one-third of the cases the figures on the packages are but slightly lower than the certified guarantees. . . . A comparison of the results of the analyses of the samples collected by the station with the percentages guaranteed by the manufacturers shows that many of the manufacturers do not intend to do much more than make good the minimum guarantee, and it is not surprising that this results in some of the goods falling below the guarantee in one or more ingredients."

The collective exhibit of German fertilizers and chemical products, Maizières (*L'Engrais, 15 (1900), No. 39, pp. 924–926*).—This article contains, among other data, statistics of the consumption of Stassfurt potash salts in different countries.

FIELD CROPS.

On the relation of climate to the size of grain of cereals, J. L. Jensen (*Tidsskr. Landbr. Planteavl, 5 (1899), pp. 138–147*).—The author secured 731 samples of barley, oats, rye, and wheat through Danish consulates in foreign countries for the purpose of studying questions relating to grain rusts and their prevention. All but 26 of the samples came from 12 different countries in Europe and America and, in addition, 83 samples were obtained from Danish farmers. The average weight of 10,000 kernels was determined for each cereal from each country. The data were then averaged for the 4 cereals men-

tioned, placing the different countries in the order of decreasing grain weights, the results being as follows:

Average grain weights of cereals from different countries.

Country.	Number of samples.	Weight of 10,000 kernels.	Country.	Number of samples.	Weight of 10,000 kernels.
		Grams.			*Grams.*
Italy	52	418	Sweden	83	329
Spain	12	392	Germany	109	325
Great Britain	72	365	Prussia	88	317
Denmark	83	362	Norway	67	306
France	47	358	United States	27	285
Netherlands	52	354	Russia	18	250
Belgium	48	347			

The countries mentioned were placed in 6 groups, according to their climatic characteristics, Russia, with strongly marked continental climate and warm summers, forming Group I; and Italy, Spain, and France, with insular and coast climate and warm summers, forming Group VI. The different groups furnish the following average data as to grain weights of the leading cereals:

Grain weights according to climatic conditions.

Group.	Countries.	Barley.	Oats.	Rye.	Wheat.	Average.	Ratio
		Grams.	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*
I	Russia	333	245	178	244	250	100
II	United States	347	253	194	346	285	11[illegible]
III	Germany, Prussia	399	302	231	353	321	128
IV	Denmark, Sweden, Norway	410	322	244	354	332	133
V	Great Britain, Netherlands, Belgium	440	311	266	405	355	142
VI	Italy, Spain, France	465	329	295	468	389	156
	Average continental climate	360	267	201	314		
	Average insular and coast climate	438	321	268	409		
	Data for continental climate=100	122	120	133	130		

The results of the investigation plainly show that the grain weights of cereals decrease in the same ratio as the continental character of the country becomes more marked and *vice versa*. The grain weight increases as the country has insular or coast climate and, in connection with such climate, it also increases with increasing temperature within the limits included by the material at hand. The different kinds of grain samples from each country were mixed and sown on experimental plats the following spring. Examinations of the grain weights of the oats and the barley harvested showed that the percentage increase in the grain weight was largest in case of the samples of Group I, viz, 12 and 20 per cent for barley and oats, respectively, and decreased almost regularly till Group VI was reached, which showed a percentage increase of 6 and 2 per cent for barley and oats, respectively. The cause of the increase in the grain weights of groups IV to VI is found in the favorable conditions of heat and rain in Denmark during the season when the crops were grown.—F. W. WOLL.

Alinit in the culture of cereals, L. MALPEAUX (*Ann. Agron., 26 (1900), No. 4, pp. 196–211*).—The author briefly reviews the work of investigators in different countries of Europe on the use of Alinit, and gives the results of his own experiments in inoculating wheat and oats with it. Both pot and field trials were made, and the soil used varied from sterile sand to rich garden soil.

In sterile soil Alinit did not increase the yields of either grain or straw, and the use of sugar did not add to its efficiency. In field soils of average fertility the same results were obtained. In garden soils the use of Alinit resulted in increased yields, seemingly due to its presence, but the increase in yield was not as great as that obtained when nitrate of soda was used.

It is concluded that to be profitable Alinit must be used in soils rich in vegetable matter and therefore favorable to the growth of nitrifying bacteria. From the results obtained in these experiments the author believes that it will be necessary to renounce the hope of replacing nitrogenous manures by inoculation of seed with pure cultures of nitrogen-fixing bacteria.

Fertilization of grain and grass lands, A. T. NEALE (*Delaware Sta. Rpt. 1899, pp. 24–26*).—The yield of the hay crop on land fertilized in 1897 with basic slag, ground bone, and acid phosphate, respectively, and with mixtures of either basic slag or ground bone with acid phosphate is given for 1899, in addition to the data already recorded for the 2 years preceding (E. S. R., 11, p. 141). The relative value of the 3 fertilizers in combinations are compared and the profits and losses for the whole 3 years' experiments discussed. Ground bone cost \$24 per ton. It was practically without effect on the grain yield of rye, but considerably increased the following crop of grass. Basic slag cost \$9 per ton. It was also negative in effect on grain, but was twice as effective as ground bone in increasing the hay yields. The profits and losses secured for the whole 3 years of the experiment are summed up by the author as follows:

"The sum total of 3 years' crops from unfertilized land is \$48.16 per acre. Fertilized land in 2 instances only equaled or exceeded this amount, viz, where the acid phosphate was used alone, from which \$52.89 represents values after fertilizer bills had been paid; and where the mixture of this phosphate with basic slag was used, this netted \$50.29.

"An investment in acid phosphate of \$1.36 per acre paid for itself the first year, and during the entire interval of 3 years returned \$4.73 profit per acre, or nearly 3 times its first cost. Of the gross return due to this phosphate, viz, \$6.09 per acre, 66 per cent must be credited to the grain and 54 per cent to the grass.

"The slag and phosphate combination returned a net profit of \$2.13 per acre. Its gross return was \$4.83, of which 70 per cent should be credited to the hay crop and 30 per cent to the grain.

"The gross return from bone and phosphate amounted to \$5.11 per acre, insufficient to meet bills for fertilizers, which amounted to \$5.80 per acre."

In the author's opinion the results obtained in this experiment point strongly to the use of acid phosphate as the most profitable fertilizing ingredient in grain and grass culture.

Comparative trial of different clover and grass mixtures for seeding, H. J. WHEELER and J. A. TILLINGHAST (*Rhode Island Sta. Rpt. 1899, pp. 168–170*).—A number of grass and clover mixtures were used for seeding different plats for the purpose of determining the relative yields and periods of maturity.

On the grass plats a mixture of *Bromus inermis*, meadow fescue, and orchard grass was used on one plat, orchard grass alone on another, and *Bromus inermis* and meadow fescue on a third. On the clover plats common red clover and alsike, respectively, were combined with timothy and redtop. The grass plats were ready to cut about 3 weeks before the clover plats, but the yields on the latter were more than double those obtained from the grass plats. For practical purposes the combination of clover, redtop, and timothy is believed to be the best mixture tried. On large farms the hay crop can be better cared for if mixtures are used which mature at different dates.

The Golden Vine field pea; its composition and yield per acre, J. STEWART (*Utah Sta. Bul. 69, pp. 313–328*).—The chemical composition (food value) and yield per acre of the whole plant and the leaves, stalks, and pods at different stages of growth were investigated. "Three-fourths of the plant consists of leaves when it is young and one-fourth of stalks. At maturity a little more than two-fifths are leaves, a little more than one-fifth stalks, and a little less than two-fifths pods. . . . The percentage of leaves decreases from youth to maturity; the percentage of stalk increases until the pods begin to form, and then decreases."

On June 19, when the peas were about 9 in. high, 88.3 per cent of the whole green plant was water. The greatest yield of both green and dry matter in the whole plant occurred July 10, after which no further growth of leaves or stalks took place. Two-thirds of the whole crop at this time consisted of leaves. Two weeks later, or July 24, the pods contained their greatest weight of both green and dry matter. The yield of dry material July 10 was, for the whole plant, 4,997 lbs. per acre, divided as follows: Leaves 3,347 lbs., stalks 1,391 lbs., flowers 259 lbs. When the pods were mature, July 24, the total yield of dry matter was 3,496 lbs., divided as follows: Leaves 1,699 lbs., stalks 689 lbs., pods 1,108 lbs.

The peas developed rapidly after they had become thoroughly established. Over four-fifths of the entire weight of the crop on July 10 had been produced during the 3 previous weeks. The following table shows the percentage composition of the whole plant and of different portions on the day when the yield of dry matter was greatest—July 10—and 2 weeks later, when the pods were mature:

Composition of Golden Vine field peas.

	July 10—just coming into bloom.				July 24—pods mature.			
	Whole plant.	Leaves.	Stalks.	Flowers.	Whole plant.	Leaves.	Stalks.	Pods.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Ash	11.33	12.25	9.70	8.11	10.68	14.07	9.33	6.32
Crude fiber	18.11	10.75	37.21	10.84	21.08	16.09	42.70	15.30
Fat	3.19	4.02	1.34	2.54	3.51	4.67	1.19	3.20
Nitrogen-free extract	40.70	41.46	38.96	40.15	44.69	46.84	41.52	43.33
Protein	26.67	31.52	12.79	38.36	20.04	18.33	5.26	31.85
Albuminoids	....	20.95	6.69	....	16.02	13.15	4.06	27.87
Amids	....	10.57	6.10	....	4.02	5.18	1.20	3.98

With the above percentages and tables showing the total yield of green and dry material at different dates, the amounts of the different food constituents and ash contained in the plant at various stages of growth are worked out. Thus July 10, when the plants were just coming into bloom, the date of greatest total yield, the nitrogen-free extract constituted 2,033 lbs. of the total yield, protein 1,333 lbs., crude fiber 905 lbs., ash 556 lbs., and fat 159 lbs. These constituents were greatest for the whole plant, leaves, and stalk on this date. The leaves were especially rich in food constituents, containing "about ten-thirteenths of the protein of the plant, about thirteen-twentieths of the nitrogen-free extent, and about thirteen-sixteenths of the fat, while they contained very little more than one-third of the crude fiber."

These data suggest the early blooming period of Golden Vine field peas as the most suitable time for harvesting to secure the greatest amount of dry matter and of food ingredients.

Rice—preparation, cultivation, flooding, and harvesting, W. C. STUBBS (*Louisiana Stas. Bul. 61, 2. ser., pp. 376–401, pls. 10*).—The lands best adapted to this crop, methods of soil preparation, planting, flooding, and harvesting the crop, varieties cultivated in both the alluvial and prairie sections of Louisiana, composition of rice and its straw, etc., are popularly discussed. Some data regarding the production of rice in Louisiana, irrigation methods employed, money invested in irrigation plants, and the acreage under irrigation are included.

In 1899 Louisiana produced 107,792,000 lbs. of rice. It is estimated that about 8,000 square miles of the alluvial and prairie lands of the State could, with some expenditure of money, be brought under cultivation and irrigation where they would be valuable for rice culture. With the present yields something like 5,000,000,000 lbs. of clean rice could be raised on this land, which is about 12 times the present consumption of rice in this country. At the present time there are about 400 miles of canals constructed in the State which irrigate some 225,000 acres of rice. These canals are filled mainly by the aid of pumping plants.

Considerable data obtained by addressing letters of inquiry to rice planters are included on the management of rice plantations.

Progress of the beet-sugar industry in the United States in 1899, with a supplementary report on the cane-sugar industry of the Hawaiian Islands (*U. S. House Representatives, 56. Cong., 1. Session, Doc. 699, pp. 200, maps 4, dgm. 1*).—This report is similar in character to that published in 1898 (E. S. R., 11, p. 535), and deals with the present status of the sugar-beet industry in this country and of the cane-sugar industry in the Hawaiian Islands.

Report of the special agent, C. F. Saylor (pp. 11–134).—A considerably detailed report is given of the operations of the sugar-beet factories in the different States during the season, data as regards capacity of plants, quantity of beets worked up, sugar produced, etc., being included. Sugar-beet factories are now in successful operation in California, New Mexico, Utah, Nebraska, New York, Oregon, Minnesota, Illinois, Washington, Colorado, and Michigan. The greatest activity in beet-sugar production during the year occurred in Michigan, where 8 new factories were put in operation. Some general information regarding the culture of sugar beets is reprinted from the report of 1898, and the feeding value of sugar-beet pulp for cattle and sheep is further discussed. The conditions incident to the distribution of the bounties offered by certain States for the production of beet sugar are recorded. Many reports from the directors of the experiment stations giving data in regard to the culture, sugar content, and purity coefficient of beets grown at the stations are given in the report. A considerable portion of these data have already been published in bulletins by the different stations.

In the discussion of the general conditions affecting the sugar industry of the Hawaiian Islands their locality, topography, and climate, soil, and trade conditions are set forth at length, the purpose being to show in a measure the probable future production of cane sugar and the bearing this will have on the sugar-beet industry in this country. The main factors which will control the production of sugar cane in the islands are the limited land areas suitable for the purpose and the cost of pumping irrigation water where irrigation is necessary and water can not be obtained by other means.

The production of sugar in the islands for 1900 is estimated at 310,000 tons, and the amount produced each year is increasing. Careful estimates place the limit of production for the islands at 500,000 tons. Present methods of cane culture and sugar manufacture in the islands are carried on largely by animal and steam power and are in a high state of development. It requires 18 months to produce the first crop of cane. Planters ratoon once and sometimes twice where they can produce 30 tons per acre, but a considerable acreage is produced without ratooning at all. The yield generally averages 5 tons of

sugar per acre, but sometimes runs as high as 14 tons. The cost of production varies from $22.50 to $44 per ton of sugar in the data given, and will average $35 or more. The profit per ton of sugar varies from $25 to $35.

Conditions that will tend to increase the cost of production are the probable higher wages that will have to be paid for labor when present contracts with Chinese and Japanese laborers expire. The annexation of the islands to the United States will prevent the emigration of Chinese to the islands and prohibit the importation of contract labor from other countries.

Statistics regarding public lands in the islands, sugar factories, imports and exports, labor, and wages are given, with descriptions of all the principal sugar plantations and factories in operation in the islands.

Report of the chemist, H. W. Wiley (pp. 136–193).—In 1898, 42,110 lbs. of sugar-beet seed was distributed by the Division of Botany of this Department, nearly one-half going to 29 of the experiment stations, and the remainder to individuals and associations. In 1899, 964 samples of beets from 41 States and Territories were received, and the data secured in their analysis by the Division of Chemistry are shown in tables and summarized for 3 years. From the data at hand the adaptation of the different States for sugar production is summed up as follows: Beet sugar can be produced profitably in California, Colorado, Michigan, Nebraska, Nevada, New York, Pennsylvania, Utah, Wisconsin, and Wyoming. It can not be produced with profit in Arkansas, District of Columbia, Georgia, Kansas, Kentucky, North Carolina, Oklahoma, South Carolina, and Tennessee. It may possibly be produced at a profit in Connecticut, Delaware, Idaho, Illinois, Indiana, Iowa, Maryland, Massachusetts, Minnesota, Missouri, Montana, New Hampshire, New Jersey, New Mexico, North Dakota, Ohio, Oregon, South Dakota, Vermont, Virginia, and Washington.

The methods employed by factories in Michigan for determining the deductions to be made for tare, the analysis of beets, etc., are given in detail.

Investigation of Sumatra tobacco, A. VAN BIJLERT (*Meded. 'S. Lands Plantentuin, 1899, No. 30, pp. 156*).—The author gives an account of work done on texture and chemical composition of 15 samples of unfermented Sumatra tobacco. Since this tobacco is used exclusively for cigar wrappers, the flavor and fragrance received no attention, but the weight, elasticity, burning quality, white ash, amount of leaf surface, together with color, spotting, etc., were carefully noted.

The relation between weight and the extent of leaf surface is given, the different measurements and weights being tabulated. From this it appears that there is no constant relation between the character of the

soil and the weight and surface area of the leaves, nor is there a constant relation between surface area and weight of a square meter; and, consequently, no relation between surface area and the number of square meters of leaf surface in 1 kg. of leaves. It also appears that the texture and weight of leaves vary as much on similar soils with the same treatment as they do on different soils or with different treatment.

The results of chemical analysis are shown in 6 tables and discussed at length, and the methods of analysis employed are described.

The most common cause of failure of the crop or of unsatisfactory quality is drought. It is held that the soils on which tobacco is grown to-day have not as great power to retain moisture as they once had. Ten years ago the crop was not ruined until 40 days had passed without rain; a few years later 24 days of drought brought failure; and at present planters complain of the extremely dry weather when but 15 days have passed without rain. The decrease in the power of soils to hold water is attributed to a change in their texture and in the humus content brought about by continuous tobacco growing and frequent burning. Tobacco grown on virgin soil or on low land where the ground water is near the surface can successfully withstand a drought that will prove disastrous to plants grown on an old field. The author points out that it is more important to know the number of days of continuous drought than to know the number of inches of rain that have fallen in a given time.

Success in tobacco growing depends primarily upon the supply of fresh water. The weather and the texture of the soil are important only as they affect the water supply and the formation and movement of salts. That the size of the soil particles is of little importance is shown by the fact that tobacco differing but slightly can be raised on white clay or on coarse sand.

Good tobacco can be grown in the neighborhood of the sea if the location is sheltered from the sea breeze so that the salt particles are not carried to the land. Good tobacco can not, however, be produced on soil which contains salt, and the presence of salt-loving wild plants indicates a soil unfit for tobacco growing.

The quality of the leaf is injured when it contains large proportions of lime, chlorids, sulphates, or nitrates. Potash is desirable since it adds to the burning qualities of the leaf. Guano is a frequent source of injury because it affords such a ready supply of nitrates. This is particularly true during periods of drought, when the nitrifying bacteria are especially active and the nitrates are not washed out of the soil by the rains. During such dry periods the plants do not make a vigorous root development and consequently they reach only a small quantity of the potash which is fixed, while the mobile salts and the lime are carried up by the ascending water current and brought within reach of the plant. The nitrates are absorbed by the plant and stored in the leaf and injure the quality of the tobacco.—H. M. PIETERS.

Researches on the vegetation of some forage plants, MONVOISIN (*Ann. Agron., 26 (1900), No. 2, pp. 77-103*).—The development of the roots and stems of vetch, crimson clover, lentils, sainfoin, alfalfa, blue melilot, Siberian melilot, burnet, English and Italian rye grass, milfoil, and other forage plants, as regards ash and nitrogen content at different periods before and after flowering, was studied. The mineral matter of the plants examined was found in greatest abundance in the roots of annuals at a period intermediate between flowering and the end of vegetation. The total nitrogenous matter was found to be greatest about the last of April and diminished from that date. The roots of legumes were richer in nitrogen than the roots of grasses. The nonalbuminoid nitrogenous material was greatest at the end of the vegetation period. The plants constantly lost in dry matter after maturity.

Results of a comparative culture experiment with French and American alfalfa, F. F. BRUIJUING, Jr. (*Orgaan Ver. Ondleer. Rijks Landbouwschool (1900), No. 154, p. 143*).—An account of plat experiments on sandy soil with Poiton, Province, and American alfalfa. Plats of each were planted the middle of April, 1899, and were cut August 1, and October 19, and a third time June 11, 1900. At the last cutting the plats were very weedy and the percentage of weeds in each plat was determined. The results recorded show that the Poiton alfalfa was the best for this sandy soil, and the American the poorest.—H. M. PIETERS.

The cassava plant—its uses and possibilities, D. R. PILLSBURY (*Tradesman, 44 (1901), No. 9, pp. 146-148*).—This article discusses the history, varieties, and uses as a food and feeding stuff and for the manufacture of beverages and starch of this plant.

The races of corn, A. S. HITCHCOCK (*Amer. Gard., 21 (1900), No. 314, pp. 869, 870*).—Dent, sweet, flint, pop, and soft corn are briefly characterized.

Chemical composition of maize and its products, H. W. WILEY (*U. S. Dept. Agr., Division of Chemistry Circ. No. 6, pp. 13*).—This is a translation into the French language by E. Gain of Bulletin No. 50 of the Division of Chemistry of this Department (E. S. R., 10, p. 624).

Flax culture experiments of the German Agricultural Society in 1899, KUHNERT (*Mitt. Deut. Landw. Gesell., 15 (1900), No. 5, pp. 49-52*).—The results of seeding different amounts of flax on various soils as regards yield of seed and fiber are reported. The soils used were medium clay, heavy clay, clay loam, sandy loam, and clay loam containing humus. Four plats of each soil were used, and 150, 180, 210, and 240 kg. per hectare of seed sown. The largest amount of seed obtained per hectare, an average of 1,610 kg., was from the heaviest seeding. The lighest seeding, however, yielded within 4 kg. of this amount, 1,606 kg. per hectare. The greatest total amount of fiber and the greatest amount of long fiber was obtained from the plats seeded at the rate of 150 kg. per hectare. These results are at variance with those obtained in preceding years, and the test is to be continued.

Experiments on hops, 1900 (*Jour. Southeast. Agr. Col. Wye, 1900, No. 9, pp. 5-18*).—Data for cultural and fertilizer experiments at several different centers.

Experiments on the growth of wheat and maize at the Cawnpore experimental farm, India, J. W. LEATHER (*Dept. Land Records and Agr., Northwestern Provinces and Oudh, Bul. 8, pp. 34, dgms. 2*).—An account is given of growing wheat and maize for a number of years in succession on the same land with and without fertilizers, and the results obtained are compared with those secured at Rothamsted and Woburn. Cattle and sheep manure and poudrette have proven about equally valuable as a fertilizer for wheat, and wheat alternated with corn has given better results than wheat grown in continuous cultivation.

Applying manures, BERTHAULT (*Semaine Agr., 20 (1900), Nos. 1013, pp. 330, 331; 1015, pp. 346, 347*).—The relative value of applying manures broadcast, in drills, and locally about the plant is considered for a number of farm crops.

A field experiment with Nitragin (kidney vetch), O. BURCHARD (*Landw. Wchnbl. Schleswig-Holstein, 50 (1900), No. 30, pp. 517, 518*).—The yield of kidney

vetch on uninoculated soil was at the rate of 12,750 lbs. of green fodder per hectare. When the soil was inoculated with pure cultures mixed with sand and harrowed deep into the soil the yield was at the rate of 15,286 lbs. per hectare. When the seed was inoculated before sowing the yield averaged 14,644 lbs. per hectare.

Memoranda of the Rothamsted experiments, 1900, J. H. GILBERT (*Report to the Lawes Agr. Trust Committee, 1900, pp. 119, figs. 2, dgms. 5*).—This report adds the data secured in 1900 to that obtained during the preceding 56 years and summarizes the whole. This work has been previously noted (E. S. R., 11, p. 842).

HORTICULTURE.

The horticultural division, F. W. CARD and G. E. ADAMS (*Rhode Island Sta. Rpt. 1899, pp. 127–138, figs. 2*).—An outline is given of the work done during the season with orchard fruits and in the pot culture of lettuce.

An experiment has been undertaken to see if one of the typical neglected and unprofitable orchards of the State can not be regenerated and put on a paying basis by ordinary attention to spraying, manuring, and cultivation. Under this treatment the trees have taken on a new lease of life and the indications are that the orchard can be made to yield good returns in the future.

A record is being kept of the blossoming period of all fruit trees at the station. Wild Goose plums blossomed too late to be cross fertilized, and hence produced no fruit.

In experiments in crossing sweet and sour varieties of cherries for the purpose of increasing the vigor of the sweet varieties and the quality of the fruit of the sour varieties, the pollen of the sour cherries failed to fructify the sweet varieties, though the fruit developed to a considerable size and formed stones, but these contained no embryo. Better results were obtained when the sour cherries were crossed by the sweet varieties. The following crosses resulted in perfect fruit: Early Richmond by Florence, Early Richmond by Black Eagle, Montmorency by Empress Eugenia, Montmorency by Florence, and Montmorency by Black Eagle.

Some experiments were undertaken to determine whether commercial fertilizers could be profitably substituted for barnyard manure in forcing lettuce. The experiments were made in pots with light, sandy, lettuce soil obtained from Auburn and with the somewhat heavier soils of the station. Manure, sand, muck, chopped-clover hay, and moss were used with the commercial fertilizers to lighten the station soil.

The result of this one test seems to indicate that as good lettuce can be grown with chemical fertilizers as with stable manures "provided something is used to lighten the soil and give it as good physical condition as is given by the use of stable manure." The chopped-clover hay used in the experiment did not have the desired effect in lightening the soil. Rotted peat and sphagnum moss, however, seemed to be very effective for this purpose.

Radishes were grown in the pots after the lettuce was removed. The largest yields were obtained from the soils in which stable manure was used; the smallest from those in which muck and chemicals were used.

An examination of the behavior of different varieties of strawberries, Duke of Bedford and S. U. Pickering (*Woburn Expt. Fruit Farm Rpt. 1900, pp. 35–82, 249–251*). In this experiment 85 varieties of strawberries have been grown for 5 years, 13 plants of each variety having been planted every year, so that in 1899 each variety was represented by plants of 5 different ages. Plants were set 2 feet apart each way. Crops from each 13 plants were gathered separately each year, and the berries counted and weighed. Other data, such as dates of first ripening in different years, meteorological conditions, deterioration of cropping power in different varieties and in size of berry, the flavor, color, firmness, and character of varieties, etc., were secured and are in part recorded. A comparison was also made with the same varieties of berries grown in various other parts of the experimental ground as regards these same points. The various features of the experiment are discussed at length. The years 1896 and 1898 were much better strawberry years than 1897 and 1899, as shown by the larger average yields, increased size of the fruit, greater yields per plant, etc., when all the varieties and ages are considered. Nevertheless, no connection could be traced between the crops obtained and the meteorological conditions observed either during or preceding the ripening period, and these observations include data on temperature, rainfall, humidity, and surface temperature.

Both the actual and relative size of the crops obtained from plants of the same or different ages varied much in different years. For example, weights of crops from 1 and 2 year old plants in 1896 stood in the proportion of 193 to 100, respectively, while in the following year the proportion was 4 to 100. The relative weights of the berries for 1, 2, and 3 year old crops were 100 : 100 : 172 in 1897 and 82 : 100 : 77 in 1898; and there was as much variation with one variety as with another. The weight of the crops increased rapidly up to 3 years, 1, 2, and 3 year old plants standing in the proportion of 31 : 100 : 122, and there was no diminution in the crop the following 2 years. In fact, there was a further increase the fifth year to 134, but since this result depends on the observations of one season only not much stress is put upon it. While the total yield of berries increased with the age of the plant, the size of the berries decreased. If the size of the berries for the 2-year old plants is taken as 100, the proportion for the different years would be as follows: First year, 115; second, 100; third, 96; fourth, 91; fifth, 82. If the value of the crop is assumed to be proportional to the yields and the size of the berries, the value of the crop from the different plants from 1 to 5

years old will show the following ratios: 34 : 100 : 117 : 111 : 110, respectively.

As regards the ripening period the averages obtained from a consideration of the data secured with all varieties show that "the cropping season of the older plants lasts longer than that of the 1-year-old plants. . . . but the advantage does not seem with any certainty to increase with the age of the plants beyond 2 years." The 1-year plants ripened their fruit earlier 3 years out of 4 than the older plants, but in 1899 the reverse was uniformly true.

A table is given in which the 20 varieties of berries that stood first in order of merit of some one quality are arranged in 7 columns, and these data are finally condensed into a list of 11 varieties which stood highest as regards the sum total of all qualities. No variety stood first in all 7 qualities or even in 5. Three varieties appeared in 4 columns and 8 in 3 columns. The variety La Constante stands at the head of the list with a mark of 173, whereas by the system of valuation adopted a marking of 6 is the best attainable. It is urged by the authors that too much value must not be placed on the list of best varieties because of the great variation in behavior exhibited by different varieties when placed under slightly different conditions, as shown by the supplementary plats.

In other parts of the experimental field 4 supplementary collections of strawberries were grown. The largest collection consisted of 64 of the varieties experimented with above. The plants in the supplementary beds were set a little closer together in some instances. The results obtained in these experiments with the different varieties frequently varied widely from the results obtained with the same varieties grown in the main bed. The variation was not at all in any one direction, nor was it constant as regards any one quality or character. Leaving out exceptional cases the variation on one supplementary plat was from 22 to 177 or as 1 : 8 in 1896; in 1898 the variation on this same plat was from 5 to 184 or as 1 : 37. A similar lack of consistency in the behavior of the varieties was observable during each year of the experiment on each supplementary plat and with all ages of plants.

"Without impugning our ground or manure there would seem to be ample explanation for the variations noticed when dealing with a short-lived, low-growing, and somewhat delicate plant. The crop must depend largely, if not chiefly, on the progress of events during the blossoming period, a slight difference in moisture of the soil, a slight depression in the ground, an almost imperceptible shelter from radiation, or a screening from ventilation, an accidental breath of wind, or a day earlier or later in the expansion of the flowers, may make all the difference whether the blossoms were affected by a night frost or not.

"Although these results may be regarded as unsatisfactory from the point of view of a mere 'testing of varieties,' they will have served their purpose well if they have done nothing more than prove the futility of experiments directed to this object only.

"Without implying that such a 'testing' may not have its uses in some cases, we

do not hesitate to say that a large proportion of the energy of many horticultural stations is entirely thrown away in making large collections of different varieties with the sole object of recording, often in a very slipshod and unscientific manner, their behavior at the station in question. Such work, indeed, does not deserve the name of experimental work, and even when conducted on rigorous quantitative principles, it is not likely to yield results of greater value, from the 'testing' point of view, than have our results with strawberries, nor to lead to a better knowledge of the respective merits of the varieties than might be obtained either from general repute or from an experienced nurseryman."

Experiments on different methods of treatment applied to apple trees, DUKE OF BEDFORD and S. U. PICKERING (*Woburn Expt. Fruit Farm Rpt. 1900, pp. 106–209, 252–257, pls. 14, dgms. 2*).—The larger part of the experimental work here reported was conducted with dwarf trees of Bramley Seedling, Cox Orange Pippin, and Potts Seedling. Each trial row usually contained 18 trees, 6 trees of each variety. Some of the experiments were repeated with Stirling Castle and others with standard trees of Bramley Cox and Lane Prince Albert. All the trees were planted in 1894–95 when the dwarfs were 3 and the standards 4 years old.

The problems investigated consisted of modifications in some one respect of the normal treatment adopted for a set of trees, and involved studies in pruning, root treatment, manuring, and planting. The normal treatment consisted in planting the trees in trenched ground and subsequently keeping the surface clean, cutting back after planting, pruning moderately in autumn, shortening growths when it appeared necessary in summer, and fertilizing with mixed minerals in autumn with a dressing of nitrate of soda in February. The results obtained were measured by (1) weighings of a certain number of air-dry leaves from the trees; and (2) measurements made in 1898 of the height, spread, and girth of the stem of the trees. Two crops of fruit were also obtained in a few instances, and in 1 or 2 cases trees were lifted and weighed. The data secured on the different phases of the experiment are recorded in considerable detail and discussed at length.

When trees were not cut back at planting nor subsequently pruned they were straggling in form and there was a general loss in vigor of growth. Nevertheless, the amount of fruit borne by such trees was in excess of the average. When the trees were cut back at planting and not subsequently pruned they assumed the general straggling form noted above but suffered no loss in vigor of growth. The experiments were slightly in favor of immediate cutting back on setting out rather than waiting until a year later. Summer pinching and summer pruning produced no noticeable results with the young trees under investigation.

Root pruning trees has resulted in checking both vigor and growth. Trees root-pruned every year were in 1898 but little more than half as large as normal trees and those pruned every other year only about

$\frac{2}{3}$ as large. "The crops borne by these trees, however, were heavy in proportion to their size." Trees carefully lifted every year and replanted at once suffered no injury thereby, but when left 3 days before planting, in imitation of commercial nursery methods, material injury resulted, amounting 4 years after the transplanting to a loss of 28 per cent in size.

The effect of growing grass about trees was most striking.

"The grass-grown trees are, after 5 years, scarcely bigger than when planted, and the actual increase in weight which they show during this time is about 18 times smaller than in the case of similar trees in tilled ground. The effect of weeds has been distinctly less than that of grass, and that of careless planting, combined with weeds and total neglect, is scarcely greater. The grassed or weed-grown area, in the majority of cases extended to about 6 ft. beyond the stems of the trees, but in the case of 2 of the varieties of standards the extent was only 3 ft., and in these instances recovery began in 1897 and now appears to be complete, so far as the vigor of the trees are concerned, although they have not made up for the loss in growth experienced before 1897. In the case of the other trees, where the ground is more efficiently grassed over, there seems to be some signs that recovery is now beginning. With those trees which have been recovering since 1897 the majority of their roots are still within the grassed area, and it seems impossible, therefore, to attribute the effects of the grass to a competition of food between the roots of the grass and those of the tree. We believe one of the main causes of the effects to be due to the large increase in the evaporation from the soil which is known to be produced by grass, the trees being thereby made to suffer from drought, with consequent deprivation of other nourishment as well; but we have reason to consider that the grass acts, also, by preventing the access of air to the roots of the trees. Further experiments have been undertaken to elucidate this action more fully."

Carelessly planted and neglected trees largely recovered when culture and attention were resumed after the first year. In these experiments carelessly planted trees resulted in an increase in growth of wood and in total weight of the tree—a surprising result which is being further studied. Mulching the ground with clean straw, hardening by rolling, or repeated digging of the soil instead of hoeing produced no appreciable results.

The effect of planting trees in hills with the ground worked from 2 to 3 ft. deep, of planting in soil mixed with flints, gravel, chalk, peat, or compost, and of planting trees too high and too low were studied. Decided results were secured only when the method employed favored an increased moisture supply to the roots—*i. e.*, with peat and compost. Both the leaf size and wood formation were increased by the use of these materials, due not so much, it is thought, to their manurial value as to their increasing the porosity and moisture of the soil. Each of the months of November, January, and March has proved equally favorably for setting out trees.

In certain experiments the blossoms were removed, resulting in a small excess in the growth and leaf weight.

"With Stirling Castle, the normal trees of which have borne much more fully than those of the other variety, the excess was much larger, amounting to 30 to 40 per cent. These trees were allowed to fruit in 1899, and immediately the excess in the size of the leaf disappeared. The crop of these trees in this one year, although it was an unfavorable year for fruit, was greater than those of the other trees throughout the 4 seasons during which the latter had been bearing."

Pecan culture, H. H. HUME (*Florida Sta. Bul. 54, pp. 185-211, pls. 3, figs. 9*).—The botany, methods of propagation and culture, varieties, and the adaptation of pecans to Florida conditions are considered.

A large portion of northern Florida is believed by the author to be especially adapted to the profitable growth of pecans. The nut does not appear to be exacting in soil requirements. Trees in Florida are found growing on soils ranging from a black hummock to the less fertile high pine lands. The opinions of writers vary as to the best soil.

Directions for growing trees from seed planted in the nursery are given. The seed bed should be prepared as for vegetables and the nuts planted on their sides 3 in. apart, in rows $2\frac{1}{2}$ ft. apart, and covered 3 in. deep. They should be planted soon after they are ripe and cultivation and fertilization given the same as with other young trees.

Varieties do not come true from seed. Grafting and budding are therefore resorted to in propagating desirable sorts. Annular and veneer shield budding or cleft and whip grafting are most common. Various other species of Hicoria have been used for stocks, but the pecan is considered most satisfactory.

A successful method of propagation recommended by a pecan grower is to plant common pecans and a big paper-shell variety close beside each other, and when 2 years old to use the paper-shell as scion and the common pecan as stock. The scion should contain 3 buds. It is taken before growth starts in the spring and kept in moist sand. Later, when the stock has plenty of sap and is putting out leaves, the ground is cleared away from the crown and an oblique cut $\frac{1}{2}$ to 1 in. in length, made from the crown upward. A similar cut is made on the scion. The graft is held in place by a mixture of clay and gray moss, well mixed and kneaded, and earth heaped over the stock. The pecan is considered difficult to work, which fact largely accounts for the high price of pecan nursery stock.

The orchard where the trees are to be set should have been in some cultivated farm or garden crop. Forty feet is believed to be sufficient distance apart for trees in Florida. If the triangular method of planting is adopted, 40 trees can be grown on an acre. Planting between the latter part of November and first of March is recommended. The trees may be set in the permanent orchard when 2 years old. If budded or grafted they will be 3 years old. A small amount of fertilizer, thoroughly incorporated with the soil about the newly set tree, is desirable. Clean cultivation may be given from March to July,

followed by a cover crop of beggar weed, cowpeas, or velvet beans; or crops of cotton, velvet beans, melons, etc., may be grown between the rows, the area devoted to these crops being more and more restricted as the trees develop.

Pecan trees have a large tap root. When transplanting, this should be cut 15 or 18 in. from the crown or back to solid wood and all injured roots removed. Root pruning trees in the nursery row is recommended. Examples of successful orchards grown from tap-root pruned trees are also noted. Pruning the tops of 1 and 2 year old trees at time of setting is not considered advisable as it tends to the development of shoots. Older trees when transplanted will require some top pruning. In general, the pruning necessary for a pecan tree is confined largely to forming the head. This should be started 3 or 4 ft. from the ground, and the strong upright center limbs cut back to induce growth of the lateral branches and give the tree a rounded form.

Some notes on the production of new varieties by crossing are given, and 18 varieties grown either in Florida or Georgia are described. The points considered desirable in estimating the value of the pecan are quality and flavor, plumpness of kernel, ease with which the kernel separates, size, and thickness of the shell. A thin-shell variety, other factors being equal, is most desirable; Stuart, Van Deman Centennial, and Frotscher are considered standard varieties. A list of nurserymen handling pecan stock is added.

Artificial pollination of carnations, Amelung (*Gartenflora, 49 (1900), No. 17, pp. 458–464, figs. 5*).—An account is given of cross pollinating *Dianthus chinensis* with the pollen of *D. caryophyllus* for the purpose of combining the vigorous growing habit and strong stems of the first with the rich color and odor of the latter. Incidentally pollen from *D. barbatus* and *D. plumarius* was also used to fertilize the Chinese carnation. The pollen of *D. barbatus* was effective, and 70 good seeds were obtained; but that of *D. plumarius* exerted no influence whatever. Some 100 seeds were obtained when *D. chinensis* was pollinated by *D. caryophyllus*. These were sown. None of the resulting carnations were alike in type, form, or leaf formation. Out of 60 blossoms only 3 were well filled. Ten of the more promising plants were set in pots, pollinated with *D. caryophyllus*, and the seed harvested in the fall. This seed, when sown the following spring, produced plants which blossomed at intervals between June 1 and September 30. Selected plants were again pollinated with *D. caryophyllus* and the operation repeated 3 times. The result of the experiment at the end of 6 years is a plant which blossoms earlier than *D. caryophyllus* and has a stronger stem. It is believed that after a few years this strain can be so fixed as to come true to seed. The experiment is further believed to show that it requires at least 10 years before satisfactory results can be obtained in cross pollinating carnations.

Gardener's assistant; a practical and scientific exposition of the art of gardening in all its branches, R. THOMPSON (*London: Gresham Pub. Co., 1900, rev. ed., Vol. I, pp. 208, pls. 3, figs 269*).

Amateur's practical garden book; containing the simplest directions for the growing of the commonest things about the house and garden, C. E. HUNN and L. H. BAILEY (*New York: Macmillan Co., Gardencraft, ser. 1900, pp. 250, figs. 169*).—The topics treated are arranged alphabetically. The more common fruits, nuts, vegetables, flowers, herbs, horticultural operations and tools, insects and diseases, etc., are considered in an elementary way.

Vegetable growing in southern Arizona, A. J. MCCLATCHIE (*Arizona Sta. Bul. 35, pp. 114–143, figs. 5*).—Cultural directions based on the results of station experience are given for growing all the more common garden vegetables. The region in southern Arizona where the station is located is essentially a desert one, with hot days, cool nights, and rapid changes from winter to summer. Irrigation is essential. The kind of vegetable to be planted each month of the year is specifically noted and directions given for preparation of the soil, cultivation, irrigating, etc. The necessity for planting only good seed is pointed out.

Vegetables out of season in every garden, E. K. TOOGOOD (*Southampton: Toogood & Sons, 1899, pp. 103, figs. 73*).—Notes on forcing structures and appliances and directions for forcing a large number of vegetables and small fruits, with data as to time of sowing and date of maturing.

The formation of fruit buds, G. H. POWELL (*Delaware Sta. Rpt. 1899, pp. 150–153*).—A study is being made of this subject in the laboratory and field, but results thus far obtained are reserved for a future report. Inconclusive data obtained in thinning experiments with Burbank and Poole Pride plums are included. Thinning slightly increased the size of the fruit but reduced the quantity and likewise the profits per tree. The value of thinning in the case of the Burbank it is thought must be found in the subsequent behavior of the tree. With Poole Pride the main advantage seemed to be the excellent condition in which the trees were left for future crops. Branches of unthinned trees were bent to the ground with the fruit and so broken that a renewal of the tops will be necessary before further crops can be grown.

Fruit culture in Queensland, A. H. BENSON (*Queensland Agr. Jour., 7 (1900), No. 5, pp. 432–438, pls. 11*).—A short account of some varieties of citrus fruits of approved merit now fruiting in the colony, with general notes on seedlings.

The chemical composition of Finnish cranberries, F. STOLLE (*Ztschr. Deut. Zuckerind., 50 (1900), No. 533, pp. 609, 610; abs. in Jour. Soc. Chem. Ind., 19 (1900), No. 9, p. 841*).—The details of the chemical method employed in isolating the sugar contained in the fruit are reported. The sugar in the cranberry was found to be pure invert sugar, and the acid, gloxylic acid.

Catalogue of fruit trees under test at the experimental farm at Agassiz, British Columbia, W. SAUNDERS and T. A. SHARPE (*Canada Cent. Expt. Farm Bul. 3, 2. ser., pp. 71*).—Alphabetical lists of the apples, crab apples, pears, plums, cherries, peaches, apricots, nectarines, quinces, medlar trees, and mulberries growing at the station with notes and a select list of the varieties suitable for cultivation in British Columbia.

Root system in the orange orchard as affected by irrigation, cultivation, and fertilization, J. H. REED (*Pacific Rural Press, 61 (1901), No. 1, pp. 4, 5*).—Paper read by the author before the University Farmers' Club Institute at Riverside, Cal.

Messina v. California lemons, J. S. VAN EPPS (*Pacific Fruit World, 10 (1901), No. 15, p. 3*).—The total weight and the weight and percentage of the peel, pulp, soluble solids, and free and combined acids of a box of California and a box of Messina lemons each containing 300 lemons are given. The California lemons contained about one-third more acid than the Messina.

The California Smyrna fig on a commercial basis, G. C. ROEDING (*California*

Fruit Grower, 25 (1900), No. 656, pp. 4-6).—Paper on this subject discussing in detail Smyrna and Adriatic classes of figs, caprification, gathering and curing, etc.

Phylloxera resistant vines for California, F. T. BIOLETTI (*Pacific Rural Press, 60 (1900), No. 25, pp. 388, 389*).—Paper read by the author at the California Fruit Growers' convention.

Preservation of grape posts, SCHELLENBERG (*Jahresber. Vers. Stat. u. Schule, Wädensweil, 1897-98, pp. 43, 44*).—Posts saturated with solutions of copper sulphate, carbolic acid preparations, or creosote, respectively, resisted rot much longer than posts not so treated.

Growing flowers for perfume, O. B. SALISBURY (*Amer. Gard., 21 (1900), No. 313, pp. 847, 848, figs. 3*).—An account, with some statistics, of the perfume industry of the city of Grasse in southeastern France.

Culture of flowers from seeds and bulbs, E. K. TOOGOOD (*Southampton: Toogood & Sons, 1900, pp. 190, fig. 54*).—Simple directions for the culture of hardy flowers.

Live covers for country homes, B. D. HALSTED (*New Jersey Stas. Bul. 144, pp. 39, pls. 15, figs. 13*).—A popular treatise on all the more common hardy climbing vines used in this country for ornamental purposes and shade for houses and other buildings. The ivies, grapes, Wistarias, Ampelopsis, trumpet creeper, Clematis, honeysuckle, climbing roses, pipe vines, matrimony vine, *Akebia quinata*, moonseed, climbing bittersweet, Actinidia, hop, and Madeira vine, and Cobea annuals are given most attention. The success or failure with many of these at other stations in different parts of the country is noted. Directions for setting vines are given, with notes on their care, diseases, etc., and a brief presentation of the objections from a sanitary standpoint sometimes urged against vines on houses.

Culture of Erica wilmorei and of similar species, H. DAUTHENAY (*Rev. Hort., 72 (1900), No. 23, pp. 663, 664*).—Details regarding propagation, care, and diseases.

Auricula (Primula auricula), J. DOUGLAS (*Garden, 58 (1900), Nos. 1515, pp. 399-401; 1516, pp. 411, 412*).—Paper on the classes of auriculas, general culture, propagation by seed, repotting, insect pests, and best varieties, with notes on alpine auriculas.

FORESTRY.

A short account of the Big Trees of California (*U. S. Dept. Agr., Division of Forestry Bul. 28, pp. 30, pls. 15, maps 2*).—This is a reprint of a report on the Big Trees of California which was issued as a Senate document. It contains a statement relative to the discovery of the groves and their distribution throughout California. The Big Tree is found only in small groves scattered along the west slope of the Sierra Nevada Mountains, from the North Fork of the American River to the head of Deer Creek, a distance of 260 miles. But 10 main groups are known, and the total number of large trees in these groups are but a few thousand, while the specimens which are remarkable for their size do not exceed 500. The different groves are described in detail, and notes are given on their age, geological history, etc. The Big Tree reproduces itself but slowly and with much uncertainty. In some groves a number of seedlings of varying size are found, while in others young trees are almost wholly wanting. A botanical description of the Big Tree is given, together with notes on its nomenclature, in which it is stated that the proper botanical

name of the tree should be *Sequoia washingtoniana*, instead of *S. gigantea*.

The Big Trees of California, W. R. DUDLEY (*Forester, 6 (1900), No. 9, pp. 206–210, fig. 1*).—The author gives a concise statement of the facts observed in an investigation of the Big-Tree regions of California, in which he visited various groves, took the measurements of the trees, studied their habitat as closely as possible, and incidentally secured information relative to their ownership. It is said there are 33 distinct groves of *Sequoia gigantea*, 8 of them north and 25 south of Kings River, California.

The result of lumbering these trees is mentioned, and the milling capacity of the various mills situated in the vicinity of the different groves is shown. The agitation that is going on for the acquirement of these groves by the Government, and their future protection, has both a sentimental and an economic value. South of the Kings River these trees are said to be an important factor in stream protection, and as such their preservation becomes an important forestry question.

Tree planting in Oklahoma, W. L. HALL (*Forester, 6 (1900), No. 6, pp. 130, 131*).—The forest conditions of Oklahoma are briefly described, together with the soils and distribution of streams. Under proper management it is said that many thousand acres of land at present almost worthless could be made to produce valuable timber at slight expense. In this region planting white elm, green ash, mulberry, catalpa, locust, Russian mulberry, hackberry, black walnut, and black cherry may be usually relied upon to be successful. Plantings of these trees should be on the lower slopes and in the valleys, but if upland planting is attempted it is stated that it should be carried on in a limited way with such trees as black locust, Russian mulberry, white elm, and hackberry.

When increase in thickness begins in trees, G. T. HASTINGS (*Science, n. ser., 12 (1900), No. 303, pp. 585, 586*).—A brief summary is given of observations made upon the beginning of increase in thickness in a number of trees. It was found that in the broad-leaved species examined no increase of thickness occurred until the buds had opened and the first leaves expanded. The first formation of new wood was in the neighborhood of the terminal bud, and was not continuous around the stem. The growth progresses gradually from the 1-year-old twigs to those 2 and 3 years old, and when the new wood begins to be formed on the 5 or 6 year old twigs, the process becomes very rapid, occurring over the entire tree. Growth usually begins and extends more rapidly on the upper and more exposed limbs, sometimes a week before any sign of growth being observed on the lower ones.

In the pines the increase in thickness began on the 2 and 3 year old twigs before it was noticed in 1-year-old twigs, or before the buds had

opened. By the time the buds were well opened growth had extended from the terminal shoot down the trunk and was just beginning on the lower branches. This exceptional behavior is attributed to the fact that the leaves, as in the case of the pine, remain on the twigs for 2 or 3 years. In the case of hemlock, which retains its leaves for 6 or 7 years, the growth at the end of May was greatest on the 6-year-old twigs, and decreased up to the 1-year-old twigs, where it was very slight. In the case of the bald cypress (*Taxodium distichum*) the conditions were quite similar to those observed for the broad-leaved, deciduous trees.

Damage to timber by acid fumes, H. S. GRAVES (*Forester, 6 (1900), No. 6, pp. 135, 136*).—An example of injury to timber by acid fumes is reported by the author as occurring at Ducktown, Tenn., where there are extensive copper mines. The crude ore is roasted in order to drive off a portion of the sulphur. The fumes, containing a large amount of sulphurous acid, are carried to a considerable distance, all grass being destroyed for about one-third of a mile, and at a distance of one-half mile certain trees are only able to maintain a sickly existence. It was found that the white pine was among the most susceptible. Trees of this variety have been killed at a distance of 7 miles from the roasting sheds.

A provisional list of trees, in the order of their relative degree of sensitiveness, is given. The list, beginning with the most sensitive, is white pine, hemlock, river birch, mulberry, white oak, chestnut oak, chestnut, black oak, red oak, ash, willow, beech, poplar, blue beech, bellwood, locust, honey locust, red maple, Virginia scrub pine, black gum, sourwood, and dogwood. The last 3 trees in the list are said to be very hardy and are found growing in excellent condition within half a mile of the works.

The forests, L. BOPPE and A. JOLYET (*Les Forêts. Paris: Baillière & Son, 1901, pp. XI+488, figs. 94*).—This book is largely based upon lectures delivered by the first author at the National Forestry School at Nancy. In the first chapters the tree as an individual is considered, followed with descriptions of all the more important species of forest trees. The forest, its soil, climatic and reciprocal relationships are discussed; after which especial attention is given to forest protection and reforestation. In the chapters on exploitation and protection especial attention is given to the injuries to forests by man, in which fires and pasturage play an important part. Many valuable suggestions are given relating to artificial reforestation, the value of different species for different surroundings and uses being discussed. Directions are given for the preparation and management of forest nurseries and forest planting. Plants suited to the different conditions are presented, attention being paid to reforestation of nonagricultural lands, mountains, and the fixation of sand dunes.

The forests of Canada, DE SEBILLE (*Bul. Soc. Cent. Forest. Belg., 7 (1900), No. 6, pp. 451-465*).—The forests of Canada are described at some length, the different regions being taken up in more or less detail. The coniferous species occurring in these forests are mentioned and their distribution briefly outlined. Thirty-one species of conifers are found in the region indicated.

Forest problems in Michigan, C. W. Garfield (*Forester, 6 (1900), No. 11, pp. 255–258*).—In a paper read before the American Forestry Association, June 26, the author reviews the preliminary movements which led up to the establishment of a State forestry commission in Michigan. The text of the law, which provides for a permanent forestry commission and defines its powers and duties, is quoted. The organization of the forestry commission is given and a brief account of the efforts on the part of this commission to enforce the law and create a public sentiment favorable to it.

Adirondack forestry problems, B. E. Fernow (*Forester, 6 (1900), No. 10, pp. 229–234*).—The acquirement of forestry lands by the State of New York is briefly reviewed, together with the legislation which has made it possible to acquire and control these forests. The main problems remaining for solution are silvicultural ones, and these will be concerned with the treatment of virgin land, culled lands, slashes or burns, and swamps.

The legislative outlook for forestry in Wisconsin, E. Brunken (*Forester, 6 (1900), No. 11, pp. 259–262*).—The forestry conditions of Wisconsin are briefly outlined and statements given relative to the prospect for legislation to correct some of the more prominent evils.

The forests of East and West Prussia (*Ztschr. Forst. u. Jagdw., 32 (1900), No. 7, pp. 381–406*).—The extent and distribution of the forests are described.

A classification of standing timber, C. Broilliard (*Rev. Eaux et Forêts, 3. ser., 4 (1900), No. 5, pp. 140–149*).—Different schemes of classification of standing timber are given which are varied to suit different species of trees.

Comparison of the strength of Ceylon timbers with that of European timbers, W. C. Unwin (*Indian Forester, 26 (1900), No. 10, pp. 521–523*).—The weight per cubic foot, crushing strength, "shearing" strength, etc., are given of 22 varieties of Ceylon timbers, comparisons being made with the same factors for oak, elm, ash, and red pine.

Second growth pine vs. agriculture, W. M. Hays (*Forester, 6 (1900), No. 9, pp. 214–216*).—Attention is called to the low value of some of the sandy pine lands in Minnesota and elsewhere after they have been denuded of timber. Such lands are quickly exhausted when cultivated, and their greatest economic value can probably be secured by maintaining them permanently under forest conditions.

The natural spreading of timber areas, C. E. Bessey (*Forester, 6 (1900), No. 10, pp. 240–243*).—The natural spreading of pine forests and deciduous trees in the prairie regions is shown, and causes sought. The principal cause of this spread is attributed to the fact of stopping prairie fires and of adjacent tillage.

Cutting, burning, and fire protection, H. B. Ayres (*Forester, 6 (1900), No. 11, pp. 266, 267*).—A brief review is given of some of the problems relating to cutting, burning, and fire protection of forests. It is stated that investigations made by the U. S. Geological Survey show that in 14 townships during 1899 more than 800,000,000 ft. of white and Norway pine was destroyed by fire. The necessity for systems of management which will prevent such wholesale loss is shown.

Some important foreign trees for use in reforestation, E. Henry (*Sta. Agron. Nancy, Bul. 3, 1900, pp. 26–39*).—A brief review of the forest conditions existing in France and elsewhere is given, in which the necessity for forest conservation is shown. Notes are given on the value of the black locust, white pine, and Douglas fir for forest planting in the east of France. The results of a number of experiments with these trees made in different parts of Europe are given, in which the author concludes that these trees are all available for reforestation experiments in France.

Profitable reforestation, E. Henry (*Rev. Eaux et Forêts, 3. ser., 4 (1900), No. 11, pp. 321–329*).—An account is given of operations in reforestation. Oaks were used and the value at the end of 34 years is said to represent 6 per cent annually on the investment.

Notes on successful reforestation, E. HENRY (*Sta. Agron. Nancy, Bul. 2, 1900, pp. 31-41*).—An account is given of the successful reforestation of 2 tracts of land in eastern France, in which the Austrian pine (*Pinus laricio*) was the principal species. The seed of this, and white pine, larch, and spruce were sown in oats, the entire expense of preparation of the land and sowing the tree seed being nearly borne by the yield of oats. At the end of 34 years the value of the forests in which the Austrian pine predominated was estimated, and the statement is made that it is equal to a 6 per cent compound interest on the capital invested.

SEEDS—WEEDS.

Crimson clover seed, A. J. PIETERS (*U. S. Dept. Agr., Division of Botany Circ. 18, rev., pp. 7, figs. 3*).—In a previous edition of this circular (E. S. R., 11, pp. 748) a description was given of the crimson clover seed and methods for its inspection. The results of a year's experience have justified the fear expressed that unless care was taken to test the germination of crimson clover seed, much poor seed would be planted and disappointment follow. During the past season more than 100 samples of crimson clover seed were sent to the Seed Laboratory for examination. Their germination varied from 0 to 99.75 per cent. The purity in most cases was good, though one sample sold as crimson clover proved to be common red clover, while another lot of seed, imported as crimson clover, was yellow trefoil. A detailed report is given upon a number of analyses made, in which comparisons are drawn between the market price of the seed and the actual value of the good seed in the sample. The statement is made that as a general principle seed should be used that is grown in the neighborhood where it is to be planted. As between imported and American-grown seed, the latter is to be preferred. However, imported seed of good vitality will generally give satisfaction in the region south of the Ohio River.

The germination of seeds from different sized fruits and from cells containing different numbers of seeds, DUKE OF BEDFORD and S. U. PICKERING (*Woburn Expt. Fruit Farm Rpt. 1900, pp. 210-217*).—In the previous report (E. S. R., 9, p. 757) the germinative power of seeds of crab apples taken from large and small fruits was reported upon. The results obtained at that time seemed to be in favor of the seeds from smaller fruits. In the present report details of experiments are given with crab apples, apples, and pears, the results of which are summarized. The general conclusion reached is that neither the size of the fruit nor the number of seeds per fruit has any certain or appreciable effect on the germinative power of the seed and probably not on the vigor of the seedlings.

Investigations on germination, L. MAQUENNE (*Ann. Agron., 26 (1900), No. 7, pp. 321-332*).—The author states that the 2 conditions which are perhaps most important in the germination of seed are the

vitality of the embryo and the amount of humidity sufficient to secure the dissolution and transportation of the reserve material in the seed, and in this contribution he makes a preliminary report on the relation between these 2 factors. The amount of moisture normally in seeds and the amount present as shown by evaporation in vacuum of a number of seeds is given, and the transformation of the reserve materials in rye, peas, and white lupines is shown.

In conclusion the author states that all his observations tend to show the preponderating rôle of diastases in the preservation and development of seeds. Those causes which retard the alteration of diastases also maintain the germinative power, and it is believed possible to indefinitely prolong the vitality of seeds by placing them under conditions in which the diastases are rendered absolutely inactive. One of the most important factors in this is the presence of moisture, all traces of which must be removed for the prolonged preservation of seed.

The effect of calcium hydrate upon germination, R. Windisch (*Landw. Vers. Stat.*, *54* (*1900*), *No. 3–4*, *pp. 283–309*).—The effect of soaking seed of various kinds in water containing from 0.1724 to 5 per cent of calcium hydrate, as shown in their germination, is reported. The seeds experimented with were wheat, barley, rye, oats, maize, rape, flax, blue and white lupines, chickpea, fodder vetch, soy beans, and horse beans. Equal lots of seed were soaked for the same time in distilled water and the germination of the 2 lots compared. The results, which are tabulated, show that wheat was uninjured by any of the treatments and the other cereals not to any appreciable extent. In some cases the germination of the seed soaked in the lime solutions was retarded and with some seeds the total germinations were considerably reduced. This seemed to be especially true with the lupines, hemp, fodder vetch, horse beans, and soy beans.

Charlock spraying, T. H. Middleton (*Univ. Col. Wales, Aberystwyth, Agr. Dept., Ann. Rpt. Field Expts. 1899, pp. 43, 44; Bd. Agr. [London], Rpt. Agr. Education and Research, 1899–1900, pp. 89, 90*).—An account is given of spraying experiments for the destruction of charlock in a field of black Tartarian oats. Copper sulphate solutions in 1.5 and 2.25 per cent solutions were employed at the rate of from 38 to 70 gal. per acre. A few days following the spraying, the oats had a brown tint and seemed to have suffered especially from the 2.25 solution. A fortnight later the unsprayed plats were a mass of yellow bloom, but on the sprayed portion but few weeds were to be found and the oats, instead of having been injured, appeared to have been distinctly benefited by the treatment. From the success which attended this experiment the author feels warranted in recommending such treatment for the destruction of charlock and gives directions for its proper application.

List of seeds of hardy herbaceous plants and of trees and shrubs (*Roy. Gard. Kew, Bul. Misc. Inform., 1901, App. I, pp. 40*).

A new seed-sorting apparatus, G. MARTINET (*Ann. Agr. Suisse, 1 (1900), No. 2, pp. 56–59, fig. 1*).—In this apparatus seeds are allowed to drop through a funnel which is curved at its lower extremity in a horizontal direction. The falling seeds acquire a certain momentum and are projected at different distances, according to their size and weight, into partitioned receptacles. The lighter seeds drop into the first receptacle while the heavier seeds are thrown farthest and intermediate grades fall between. A blast of air directed against the seeds as they leave the funnel aids in the separation.

Some results are recorded which show the germinating power of seed collected in the different receptacles.

Rice weeds in Louisiana, W. R. DODSON (*Louisiana Stas. Bul. 61, 2. ser., pp. 402–437, figs. 17*).—An account is given of the more important weeds occurring in the rice fields of Louisiana, and the methods of their distribution are discussed at considerable length. Various means of destruction are suggested; among them, burning, late plowing, flooding, hand weeding, etc. Among the weeds the most troublesome is that known as red rice, which is a variety of the cultivated rice. Among the other weeds described are the large indigo (*Sesban* or *Sesbania macrocarpa*), the curly indigo (*Æschynomene virginica*), tadpole grass (*Rhynchospora corniculata*), bull grass (*Panicum agrostidiforme*), etc.

DISEASES OF PLANTS.

Upon the after effect of sulphur when applied to soils for the purpose of preventing potato scab, H. J. WHEELER, B. L. HARTWELL, and N. L. C. MOORE (*Rhode Island Sta. Rpt. 1899, pp. 163–167*).—In a previous bulletin of this station (E. S. R., 8, p. 797) the effect of sulphur applied at the rate of 600 lbs. per acre in the prevention of potato scab was described. In 1897 similar experiments were continued in which sulphur at the rate of 300 lbs. per acre was used, the seed tubers being rolled in sulphur and the sulphur not adhering to the tubers being dusted over them before covering in the hills. As a result of this treatment the number of scabby tubers was reduced about 9 per cent. An injurious action of sulphur upon the plants was noticed where no lime had been applied to the soil. The germicidal action of sulphur is explained by the acid liberated by the oxidation of the sulphur. On neutral or slightly alkaline soil a more marked influence as a preventive of scab would be expected.

In 1898 experiments were conducted to ascertain the after effect of applications of sulphur under various soil conditions. These experiments were conducted in galvanized-iron pots, the soil having been taken from pots which had been used the 2 previous years in experiments on potato scab. Each pot received a fertilizer of nitrate of soda, acid phosphate, muriate of potash, and high-grade sulphate of potash. Different pots received lime, wood ashes, or some form of calcium. Comparisons were made with and without sulphur. The experiments were conducted with oats and millet. The results, which

show the weights of air dry plants in the different pots, are tabulated, in which it appears that "sulphur employed in considerable quantities upon soils which are acid or which contain but a limited excess of basic ingredients is capable of causing much subsequent injury to crops, the extent of the same being greatest upon acid or neutral soils." It is further stated that the application of sulphur to soils for the prevention of potato scab regardless of the character of the soil is liable to occasionally cause much injury. The authors state that sulphate of ammonia, which has a high manurial value, gives promise of being more satisfactory and economical than flowers of sulphur as a means of lessening the tendency to scab in contaminated soils which are favorable to the growth of the fungus.

Experiments in the prevention of tomato blights, G. H. POWELL (*Delaware Sta. Rpt. 1899, pp. 153-156*).—Reports are given of experiments in spraying tomato plants in 1898-99 with Bordeaux mixture for the prevention of tomato blights. In 1898 various plats were sprayed at different times and with different numbers of applications. The results obtained were of a decidedly conflicting nature, some of the check plats yielding more than some of the sprayed ones. The results obtained indicated that Bordeaux mixture did not check the progress of the disease, although it was visible upon the foliage throughout the season.

In 1899 the experiments were repeated. One lot of 100 plants was covered with Bordeaux mixture from the time of their appearance above ground until the ripening of the first fruits; a similar lot was kept thoroughly sprayed from the time the plants were set in the field to the ripening of the first fruits; a third lot was sprayed from the time of setting first fruits to their ripening, and a fourth lot was retained as a check. Records were kept of the number, weight, and diseased character of all the fruits, the results of which are shown in tabular form. The plants sprayed from the time of their appearance in the seed bed gained at the rate of 2.45 tons per acre; those sprayed from the time of setting in the field, 1.24 tons; while those sprayed from the time of the setting of first fruits until their ripening gained 2.25 tons per acre. The tomato blight appeared on none of the plants until late in the summer, after which all the plants seemed to be affected alike, the foliage dropping from the sprayed as well as the check plants.

The value of Bordeaux mixture in these experiments seems to be shown in the increased vigor of the plants, having stimulated them to a more rapid growth. It was of particular merit in keeping down the attacks of flea-beetles, and spraying the seed bed is thought advisable by the author, especially if it should be on land previously set to tomatoes.

Report on the treatment of apple scab, 1898, F. D. CHESTER

(*Delaware Sta. Rpt. 1899, pp. 27–30, dgm. 1*).—In continuation of previous investigations, the fourth year's report is given of spraying experiments conducted on Winesap and Strawberry apple trees. Bordeaux mixture, composed of 6 lbs. of copper sulphate, 6 lbs. of lime, and 50 gals. of water, was applied to the trees, the first application being made when the buds were swelling, the second just after the petals had fallen, and the third at the time the fruits were about the size of peas. At the third spraying 4 ozs. of Paris green was added to each barrel of fungicide.

The effect of the spraying, as shown by the yield of Winesap apples, is reported, the Strawberry apple trees not having produced any fruit. At the close of the season the Strawberry apple trees had produced an abundance of fruit buds, with good foliage, while the unsprayed trees had lost their leaves and were in poor condition. The yield of the Winesap apples is tabulated, from which it appears that the trees receiving 3 sprayings bore 68.2 per cent first class, 16.6 per cent second class, and 15.2 per cent third class fruit which were badly scabbed, while the unsprayed trees produced 14.7 per cent first class, 33.1 per cent second class, and 52.2 per cent third class fruit.

Peach-leaf curl, its nature and treatment, N. B. PIERCE (*U. S. Dept. Agr., Division of Vegetable Physiology and Pathology Bul. 20, pp. 204, pls. 30, figs. 10*).—The author's investigations show that peach-leaf curl has a widespread distribution and in humid localities is a hindrance to peach culture. The disease is caused by the parasitic fungus, *Exoascus deformans*, the ravages of which are largely dependent upon the atmospheric conditions prevailing while the trees are leafing out. Rains and cold weather at that time increase the severity of the disease by favoring the growth of the parasite. For this reason, orchards near large bodies of water and in low, damp situations are more subject to leaf curl than those in dry regions or elevated situations. An extensive account is given on the life history of the fungus causing the disease. The mycelium of diseased leaves is found to be connected through the leaf petiole with the mycelium of the infected limb. Much of the spring infection probably occurs through the wintering mycelium of the branch, but this is not considered the common mode of infection of the leaves. It seems that most of the spring infections of the peach occur from spores that winter on the tree and about the newly formed buds, and most of the infected leaves fall off without infecting the branch which bears them. The mycelium of badly infected leaves sometimes passes into the branch and this mycelium in some instances may follow the branch for 1 or, at most, a few internodes and possibly infect some adjoining buds. Badly infested branches usually die during the year, while in a comparatively few instances they may support a living mycelium capable of inducing spring infection upon opening buds. Most of the spring infections

are due to the spores of the fungus and not to a perennial mycelium as was formerly believed.

Leaf curl has been successfully treated since about 1880 and copper sulphate sprays are found to be more effective than sulphur or other fungicides. On the whole, Bordeaux mixture in the proportion of 5 lbs. of copper sulphate, 5 lbs. of lime, and 45 gal. of water, gives the best results. This should be applied shortly before the opening of the fresh buds. In this way 95 to 98 per cent of the spring foliage may be saved. By thorough spraying with Bordeaux mixture, gains of $427.80 per acre are recorded where trees were planted at distances 25 ft. each way. The trees should be sprayed each season, as the experiments prove that treatment one season may not prevent disease the following year. The proper time for winter spraying and the number of applications depend on the locality, season, etc., but the most good is likely to follow if applied from 1 to 3 weeks before the opening of the blossoms in the spring. A proper time to apply the spray is in calm weather, during the middle of the day. Of nearly 200 varieties of peach and nectarine examined, it was found that very few were wholly free from this disease, while some were very subject to it; but it was demonstrated that a single winter treatment will prevent disease even upon those varieties which are most subject to it.

Treatment for the prevention of brunissure, E. ZACHAREWICZ (*Prog. Agr. et Vit. (Éd. L'Est), 21 (1900), No. 47, pp. 637, 638*).—An account is given of experiments to combat brunissure in vineyards whose yield of grapes had greatly depreciated on account of this disease. In October, 1898, the vines were given a thorough spraying with a 30 per cent solution of iron sulphate. In November a fertilizer composed of sulphate of potash, superphosphate of lime, and plaster was given the different vines, followed in March by an application of nitrate of soda. A second spraying was given, in which a 20 per cent solution of iron sulphate was used. In 1899 the vines which had received this treatment were much more vigorous than the others, and the yield was materially increased, although the disease had not entirely disappeared. A similar treatment was given them in 1900 with very satisfactory results, the disease having almost entirely disappeared on the treated vines, although abundant on those not having been given any preventive treatment.

Carnation-stem rot, F. W. CARD and G. E. ADAMS (*Rhode Island Sta. Rpt. 1899, pp. 131–135*).—A series of experiments are reported upon which were conducted in 1899 with the hope of ascertaining methods for caring for carnations which are attacked by stem rot caused by different species of fungi. Fifteen hundred cuttings of a very susceptible variety (Flora Hill) were secured and divided into lots of 100 each and submitted to different treatments. Healthy and diseased cuttings were grown in clean sand and sand on which carna-

tions had been previously grown. Chemical fertilizers and stable manures were compared, and the effect of dipping cuttings in Bordeaux mixture before planting was tested. The results of the different treatments are given at some length, but definite conclusions are not warranted from the experiments of a single season.

The most marked results were obtained in the use of fresh clean sand. Dipping the cuttings in Bordeaux mixture before placing in the cutting bed was attended with considerable loss, so that it is believed such treatment is unsafe. The general belief that stable manure in the soil favors the progress of the disease was not sustained in the trials made by the authors. The most important points for practice brought out by their experiments seem to be the superior value of sand and soil in which carnations have not been previously grown. It is said that one of the species of fungi causing the disease is believed to be the same as that producing the rot of sugar beets and the damping off of other plants. Should this prove true upon further examination, soils where such plants have been grown should not be used for growing carnations.

Botrytis and Sclerotinia: Their relation to certain plant diseases and to one another, R. E. SMITH (*Bot. Gaz., 29 (1900), No. 6, pp. 369–407, pls. 3, figs. 3*).—A report is given of several years' investigation of a disease of hothouse lettuce, and incidentally diseases of a number of other plants are mentioned and described. In the course of the author's studies it became apparent that there were different forms of lettuce diseases, all of which were generally characterized by the name of lettuce rot. The first form described is characterized by a soft, dark, decayed spot on the stem of the plant near the surface of the soil. This spreads rapidly, penetrating the stem and involving the bases of the lower leaves. With further progress of the decay, the center of the head becomes attacked and soon collapses into a fetid, slimy mass. Plants growing finely and approaching maturity suddenly collapse; the stem at the surface of the ground and the bases of the leaves are found to be rotted, and in a day or two the plant is completely gone. This form of disease is what the author characterizes as the Botrytis type and is due to *Botrytis vulgaris*. A second form, known as the no-Botrytis type, is far more common. In this disease no conidial form has ever been found. In general effect the disease is similar to that already described and is entirely indistinguishable from it. Affected plants wilt and collapse, and in a few days are entirely destroyed. Associated with the usual mycelium in the stem is an abundant white, woolly mycelium proceeding from the affected plants to the surrounding cell, where it flourishes luxuriantly, often spreading to and attacking adjacent plants. No reproductive bodies could be obtained, but infection experiments were easily performed by the

use of diseased tissue or masses of mycelium. The results obtained in these experiments show that the cause of this disease is an active parasite capable of causing the disease at any age of the plants, but at the same time the organism is able to flourish under purely saprophytic conditions. It was found that sterilizing the soil to a depth of 3 in. completely prevented the occurrence of this type of disease.

The third type in its effect upon the host is similar to those just described, but no Botrytis appeared. From the sclerotia placed in wet sand numerous trumpet-shaped *Peziza apothecia* appeared, and the fungus was determined as a typical form of *Sclerotinia libertiana*. The author's conclusions are that the lettuce "drop" in Massachusetts is caused by 2 distinct species of fungus, *Botrytis vulgaris* and *Sclerotinia libertiana*. These 2 fungi are remarkably alike in many respects, and have a similar effect upon the host plant. Most of the diseases were caused by degenerated forms of Sclerotinia which have almost entirely lost the ability to reproduce themselves by spores and have become highly specialized as a vegetative facultative parasite. The disease caused by *Botrytis vulgaris* and the typical form of *Sclerotinia libertiana* in mature plants is rare.

Notes are given on a number of diseases which have been attributed by different authors to Sclerotinia and Botrytis. Among those described are diseases of hemp, rape, potato, cucumber, and various rots of vegetables and fruits. Of diseases due to Botrytis alone the author describes a new disease of the linden, in which the branches and upper part of the stem show no abnormal symptoms, while the lower part from the surface of the ground to a height of several inches showed numerous excrescences breaking through the epidermis. This disease seems to be, as far as the author's observations go, a nursery stock disease that results in the bark of the lower part of the stem being destroyed and the wood laid bare. It is believed that this disease is caused solely by *Botrytis cinerea*, which in this case is a true parasite. A disease of rose twigs in hothouses, due to Botrytis, is briefly described, and a number of other diseases due to this group of fungi is mentioned.

The author concludes that there is no connection whatsoever between *Sclerotinia libertiana* and *Botrytis cinerea*. The connection between the 2 species which has been frequently claimed is due to their simultaneous occurrence and similarity of mycelium as well as their effect on the host.

Two diseases of red cedar, caused by Polyporus juniperinus n. sp. and P. carneus, H. von Schrenk (*U. S. Dept. Agr., Division of Vegetable Physiology and Pathology Bul. 21, pp. 22, pls. 8*).—Examination was made by the author of the cause of a diseased condition noticed in the wood of the red cedars of the United States, *Juniperus*

virginiana and *J. barbadensis*. Hitherto but few diseases of the red cedar have been described, the most important being the so-called cedar apples, due to a species of Gymnosporangium.

The mycelia of 2 fungi were observed growing in the heartwood of many trees and bringing about characteristic changes which rendered the wood unfit for lumber. A study conducted in central Tennessee and southern Missouri showed that these 2 forms of decay were present in each region. The most striking form is one called white rot of the red cedar, due to *Polyporus juniperinus*. It causes long holes in the heartwood, which often unite, making tubes through the entire trunk. At first the holes are separated by long stretches of wood which is apparently unchanged, but closer examination shows this wood is of a reddish-brown color instead of the deep red of sound wood. The holes are lined with a brilliant white coating, which consists of almost pure cellulose of the original wood, the incrusting lignin substances having been removed. In the larger holes the amount of wood fiber which has been reduced to cellulose is very considerable. In the older holes the white lining is almost absent, the walls at this time being covered with a felt of soft brown mycelium.

The changes which the fungus causes in the wood are described at considerable length. The fungus apparently enters the trunk through a dead branch and when the hyphæ reach the heartwood they grow both upward and downward. This disease is seldom noticed in trees 25 years old, but is most abundant in those considerably older. A study of the fruiting body of the fungus has shown that it is a new species, and a description is given of it.

The second disease is described as that called red rot, or pecky cedar. This is perhaps more common than white rot and has been observed in cedar trees over a considerable portion of eastern United States and also in specimens received from Bermuda, and has also been observed on arbor vitæ in Maine, where it produces the characteristic brown pockets. Wood affected with this disease is full of these spots. In the early stages these are free from one another and are more or less filled with a brown metamorphosed wood substance, which is cracked so as to form small cubes adhering to the walls of the pockets. The pockets are of different sizes, varying in length from 1 in. to several feet. In cross section they are nearly circular when small but become irregular when old, and frequently a number join together, making large irregular holes full of brown wood which has the appearance and properties of brown charcoal. The line of demarcation between the brown wood and the normal heartwood is very sharp.

The structural changes caused by this fungus are described, as well as the mycelium and fruiting body. Although mature spores have not been found, on account of its flesh-colored hymenium it was regarded as a form of *Polyporus carneus*.

The fungi causing the 2 diseases above described are believed to be wound parasites which grow in the heartwood of living trees, rendering the wood unfit for commercial purposes. Frequently diseased trees are cut and sold as an inferior grade of fence posts, although apparently they last almost as long as sound ones. The natural supply of red cedar still available is very small and any remedies which might be suggested in connection with these 2 diseases must be applicable to trees growing under modern methods of forestry for lumber or ornament. After a tree has once become affected, remedies will not avail.

The more important fungus diseases of agricultural plants and means for their prevention, E. HOTTER (*Die wichtigsten Pilzkrankheiten der landwirthschaftlichen Kulturgewächse und ihre Bekämpfung. Graz: Leuschner & Lubensky, 1900, pp. 60, figs. 47*).

Some parasitic fungi of cultivated plants, G. BRIOSI and F. CAVARA (*I funghi parassiti delle piante coltivate od utili essiccati, delineati e descritti, Fasc. XIII, XIV. Pavia, 1900; abs. in Bot. Centbl., 84 (1900), No. 1, pp. 14, 15*).—In a list of 50 species of parasitic fungi, the authors have described the following new species: *Ovularia medicaginis*, parasitic on alfalfa leaves; *Melogramma henriquetii*, on branches of cork oak; *Ramularia valiisumbrosæ*, on narcissus leaves; *Cercospora ariminensis*, on sulla leaves; *C. helianthemi*, on helianthemum; *C. hypophylla*, on *Rosa canina; C. ticinensis*, on leaves of *Sambucus nigra; Ascochyta polemonii*, on polemonium; and *Lepothyrium peronæ*, on peony leaves.

Potato and apple scab, G. E. STONE (*Massachusetts State Bd. Agr. Leaflet No. 7, pp. 4, figs. 2*).—A popular description is given of the potato scab, caused by *Oospora scabies*, and the treatment of the seed tubers with corrosive sublimate or formalin solutions recommended. The apple scab, due to *Fusicladium dendriticum*, is briefly described, and as remedies the author recommends 5 sprayings with Bordeaux mixture in which Paris green is added to the second and third for the destruction of the cankerworm, curculio, etc.

The black knot of the plum and cherry, G. E. STONE (*Massachusetts State Bd. Agr. Leaflet No. 8, pp. 4, figs. 2*).—The black knot of the plum and cherry, caused by the fungus *Plowrightia morbosa*, is popularly described and remedies suggested. Spraying with Bordeaux mixture and careful attention to orchards, and the removal of all badly infested trees, are recommended.

The black leaf spot of maples, E. MARCHAL and J. HUBERTY (*Bul. Soc. Cent. Forst. Belg., 7 (1900), No. 1, pp. 1–4, fig. 1*).—A description is given of the leaf spot caused by the fungus *Rhytisma acerinum*. This disease usually makes its appearance in Belgium in the month of July and may prove of considerable injury, especially to nursery stock.

An experiment in its prevention is briefly outlined, in which nitrate of soda at the rate of 250 kg. per hectare was used as a fertilizer with decided advantage. The disease was very abundant in maple plantations surrounding the plats, as well as on the check plat, but the area receiving the nitrate of soda remained absolutely free from the disease.

A red mold, R. G. CURTIS (*Proc. Indiana Acad. Sci., 1898, pp. 202–208, pls. 4*).—Descriptive notes are given in which the characteristics exhibited during the growth of a red mold are described.

Notes on Aspergillus oryzæ, KATHERINE E. GOLDEN (*Proc. Indiana Acad. Sci., 1898, pp. 189–201, pls. 5*).—Notes are given on the history, morphology, and physiological characteristics of this well-known Japanese mold. The author's investigations showed, so far as her experiments went, that there was no indication that

A. oryzæ has the power of causing alcoholic fermentation or of being transformed through any conditions into a yeast, as has been frequently claimed.

Notes on Peltandra rust, F. H. BLODGETT (*Science, n. ser., 12 (1900), No. 303, pp. 581, 582*).—An abstract is given of a paper in which a rust of Peltandra is described. The disease was first noticed in the New York Botanical Gardens where some leaves were infested upon nearly every plant. Usually the upper portion of the petiole was most severely attacked. In the worst cases the midrib and its branches and the petiole nearly to the water, would be covered with the rust. In such cases the plants suffered severely from a bacterial rot. The fungus causing this rust is determined as *Cæomurus caladii.*

A new parasite of Polygonatum, A. JACZEWSKI (*Hedwigia, 39 (1900), No. 3, Beihefte, p. 81, fig. 1*).—*Cylindrosporium komarowi* is described.

The perithecial form of Cercospora cerasella and its development, R. ADERHOLD (*Ber. Deut. Bot. Gesell., 18 (1900), No. 6, pp. 246–249*).—*Mycosphærella cerasella* is described as the perithecial form of *Cercospora cerasella.* It is found on fallen cherry leaves where it winters.

The mistletoe as an enemy to orchard and forest trees, E. S. ZÜRN (*Prakt. Bl. Pflanzenschutz, 1900, Nos. 3, pp. 19–21; 5, pp. 34, 35*).

The resistance of cereal smuts to formalin and hot water, W. STUART (*Proc. Indiana Acad. Sci., 1898, pp. 64–70*).—Experiments are reported in which the resistance of the smuts of wheat and oats to formalin and hot water was tested. Seed of both these cereals was subjected to hot water treatment at temperatures ranging from 110 to 140° F.; and other lots were soaked in $\frac{1}{4}$ to $\frac{1}{2}$ per cent solution of the formalin, and the effect of the treatment as shown in the germination of the seed and cultures of the fungus spores is given in tabular form. It appears that the spores are much more easily injured than the grain, either when given the hot water or formalin treatment. The essential feature in either treatment is to bring the solution in contact with the seed for sufficient time to enable it to reach the smut spores. The advantage possessed by formalin over hot water lies in the greater ease of its application.

The injurious effects of sulphur upon grapes in strong sunlight (*Hessische Landw. Ztschr., 70 (1900), No 42, pp. 584–586*).—Rather serious injury to the foliage and fruit of grapes is attributed to applications of sulphur during a period of clear, bright days with a rather high temperature.

ENTOMOLOGY.

Notes on the mosquitoes of the United States, L. O. HOWARD (*U. S. Dept. Agr., Division of Entomology Bul. 25, n. ser., pp. 70, figs. 22*).—The author discusses the subjects of the abundance of mosquitoes, Alaskan and other far-northern mosquitoes, length of life of the adult mosquito, life history of mosquitoes in general, food of adult mosquitoes, and the distance to which mosquitoes can fly.

Observations were made and experiments conducted to determine how long mosquito larvæ can live out of water or in wet mud. Some cases have been reported where mosquito larvæ are said to have lived in the muddy bed of dried-up ponds for a period of a week or more. Experiments in glass vessels indicated, however, that the larvæ could not live longer than 48 hours in mud. The synoptic tables published in Circular 40 of the Division of Entomology for the identification of mosquitoes in the United States are reproduced. The life history of Culex is reprinted from Bulletin 4, n. ser.

The adult of *Anopheles quadrimaculatus* is readily distinguished from species of Culex by the attitude of the body when at rest, the position being such as to keep the body in a straight line, whatever the angle made with the substratum may be, and the note of the female which is lower in tone than that of species of Culex. The eggs of Anopheles are laid in a loose mass floating upon the surface of the water, each egg lying upon its side instead of standing upon its end as in the case of Culex. They are not firmly attached together. The larva of *A. quadrimaculatus* remains habitually at the surface of the water. Its breathing tube is shorter than that of Culex and its body is held parallel to the surface. The natural food of the larvæ consists of spores of Algæ, minute sticks, and bits of cast larval skins. In the final larval stage of this species the diameter of the thorax becomes much greater than in previous stages as compared with the rest of the body. The generation studied by the author occupied 3 days in the egg stage, 16 days in the larval stage, and 5 days in the pupal stage, making a total period of 24 days in the earlier stages. Natural breeding grounds for this species were found in Maryland, Virginia, and the District of Columbia. Three species of this genus have been recognized in the United States, *A. quadrimaculatus*, *A. punctipennis*, and *A. crucians*. Brief notes are also presented on the genera Psorophora, Megarhinus, and Ædes.

The natural enemies of mosquitoes are the larvæ of dragon flies and the larvæ of Dytiscidæ, Hydrophilidæ, and Gyrinidæ, beside fish, nighthawks, whippoorwills, bats, etc.

Of the artificial remedies for use in houses the best results have been obtained by burning pyrethrum powder, and catching mosquitoes on the walls in kerosene cups, in cases where screening and mosquito bars do not successfully keep out all the mosquitoes. In the destruction of larvæ in breeding places, the use of a kerosene film upon the surface of stagnant pools is again recommended. Permanganate of potash which was heralded in the newspapers as a certain remedy for mosquito larvæ, is thoroughly discredited by experiments. Tar and its compounds have also been recommended, but experiments indicated them to be rather unsatisfactory as compared with the heavier grades of kerosene. The planting of eucalyptus trees in the neighborhood of houses seems to have the effect of keeping the mosquitoes away. The most efficient remedy, however, for the mosquito nuisance is the thorough drainage of all pools in which the larvæ breed.

On the resting position of Anopheles, L. W. Sambon and G. C. Low (*British Med. Jour., 1900, No. 2077, p. 1158*).—The authors made extended observations on the habits of *Anopheles claviger*, which is said to be the most common species of this genus in Italy. It is maintained that previous statements that standing on its head is a common resting position of this species is incorrect. Species of Culex

and Anopheles frequently rest with the third pair of legs lifted away from the support. The authors noted that the legs of *A. claviger* were stretched out with the tarsi pointing downward, while those of certain species of Culex were curved upward. The habit of resting, with the body at a very wide angle to the substratum, was noted in *A. pseudopictus*. In *A. superpictus* the resting position was the same as in *A. claviger*. The authors state that the resting attitude of these mosquitoes can not be used for the purpose of distinguishing the genera Culex and Anopheles, but may furnish characters for separating species of Anopheles.

Notes on insect pests from the entomological section, Indian Museum, E. BARLOW (*Indian Mus. Notes, 5 (1900), No. 1, pp. 14–34, pl. 1*).—*Serica assamensis* is reported from Assam as destructive to tea plants. The author gives a brief description of this beetle. The insect occurs in large numbers and commits serious depredations upon tea plantations. Experiments conducted by tea raisers indicate that ordinary insecticides are not very effective against this beetle. *Heterusia cingala* depredates upon the tea plant. A Tachinid parasite, *Exorista heterusiæ*, was bred from this insect.

Hispa ænescens is reported as destructive to rice crops. The insect makes its appearance in June and July. It attacks first the leaves and later the heads. *Epacromia dorsalis* is reported as an enemy to the young wheat crop in Bombay and other parts of India. *Hieroglyphus furcifer* is another grasshopper which is said to be very injurious to rice and grass crops.

Brief economic and biological notes are given on the sorghum borer moth (*Chilo simplex*) and *Heliothis armigera*.

Detailed tables are given showing the amount of damage done by locusts, especially by *Acridium peregrinum;* and brief accounts of insects injurious to mango trees, grapes, teak trees, and sal trees.

Experiments in rearing the San José scale, L. REH (*Bot. Mus., Abt. Pflanzenschutz, Hamburg, 2 (1899–1900), pp. 21, fig. 1*).—In order to rear the San José scale upon American apples, it is necessary to have sound, fresh apples which will remain fresh until after the reproductive period of this insect. Beside these conditions, a suitable temperature must be maintained. The author made observations upon 54 larvæ which were reared from San José scale upon apples. These larvæ issued in May, June, July, and August. The greater number of them were found in May. He studied the distribution of these larvæ upon the apple, and found that 38 per cent crawled into the basin of the apple, and 62 per cent into the cavity at the stem end. Detailed notes are given on the appearance of the larvæ in different stages, the secretion of the scale, and the loss of locomotion. The author observed that the old females shed their scales and secreted masses of a white woolly substance 2 or 3 days previous to the begin-

ning of the reproductive period. The majority of larvæ reared in this manner fails to come to maturity, partly for the reason that the apples begin to decay and fungus mycelia interfere with the life of the larvæ. Two stages were distinguished in the life of the sessile protected larvæ: one in which the appendages assisted the animal in locomotion, and a second in which the soft parts of the appendages were resorbed and the appendages became immovable. The author believes that more emphasis should be laid on the fact that the exuviæ contribute to the formation of the permanent scale, and that 2 independent scales are formed out of wax previous to this time. A bibliography of the subject is appended to the article.

Field experiments with the strawberry root aphis, G. H. POWELL (*Delaware Sta. Rpt. 1899, pp. 157–162*).—A number of experiments were conducted with remedies against the strawberry root aphis. Infested strawberry plants were dipped in a strong solution of tobacco water before being set in the field, with the result that no apparent effect was produced on the root aphis. Experiments were tried to determine the effect upon the root aphis of fertilizing soil with muriate of potash, kainit, and tobacco. Kainit was applied in quantities varying from 500 to 1,250 lbs. per acre, muriate of potash from 150 to 600 lbs., and tobacco from 500 to 2,000 lbs. The results of this experiment indicated that it is unsafe to apply muriate of potash to strawberry plants in rows; that not more than 750 lbs. of kainit should be applied to the acre; that no injury resulted from the tobacco dust; and that the different treatments had no effect on the multiplication of the insect.

In another experiment the surface soil was removed from the sides of several infested rows and the trenches thus formed were filled with tobacco dust and covered with soil. Upon examination a month later, after copious rains had fallen, no effect was noted on the aphis. Experiments were tried in scattering tobacco dust over the strawberry plants and on the soil for from 3 to 4 in. each side of the row. Applications of tobacco dust were made in April, June, July, and August. As no decrease in the number of aphis was noted, even where tobacco had been applied at the rate of 1 ton per acre, the experiment was abandoned.

In 1898, a piece of ground at the experiment station, which was infested in 1897, was planted with Lima beans and cowpeas. In 1899, this ground was again set in strawberries. The rotation of crops had the effect of greatly reducing the seriousness of infestation.

Brief notes are given on the life history and habits of this insect, but the life history is thus far not worked out completely. The experience of strawberry growers indicated that the most serious infestation occurs on land that has been planted to corn during the previous year. An apparent explanation of this fact is to be found in the

agency of ants in spreading infestation by the aphis. The same species of ants attend on the corn aphis and strawberry root aphis.

The currant gall mite (Phytoptus ribis), DUKE OF BEDFORD and S. U. PICKERING (*Woburn Expt. Fruit Farm Rpt. 1900, pp. 7–34, figs. 4*).—Experiments with insecticide treatments against this insect were made by the authors with the assistance of Miss Ormerod and Mr. Newstead. The mites are found in large numbers in each infested bud, 3,000 being found in some buds. This species is so minute that its transportation by wind and other agencies is rendered comparatively easy. Its period of activity extends apparently over the whole season during which currants bear leaves. During the time that the mite is inclosed in the bud it is well protected from the action of insecticides. In 1896 Baldwin Black currants showed signs of being infested by the mite and the galls were removed. The infestation increased, however, during the next year and extended to the Black Naples currant. The galls were again removed, but a further increase in infestation was noticed the following year. Although the affected buds were removed each year, the number of infested buds on the currant bushes was doubled in 1 case and increased fourfold in another. The method of removing the infested buds seems, therefore, to promise little success. In the first series of experiments with insecticides from December, 1897, to October, 1898, each experiment involved 30 bushes in a double row subjected to the same treatment. All liquid insecticides were applied from a rose can or spraying apparatus. Some of the bushes were lifted and dipped bodily into some insecticide, while still others were painted with the insecticide. The insecticides which were used included carbolic acid 0.8, 1.6, and 2.4 per cent, calcium sulphate 1.5, 3, and 4.5 per cent and mixed to the consistency of paint, 3 qts. to 10 lbs. of clay, kerosene emulsion in a number of strengths, Antinonnin, and turpentine. One week after each treatment twigs from bushes in all experiments where insecticides had been used at their maximum strength were subjected to microscopical examination. The results for the most part were of a negative character. Bushes treated with Antinonnin were reported to have been infested with the greatest number of mites on February 26, while on March 22 similar observations were made as to both mites and eggs on bushes treated with Antinonnin. On April 22 currant bushes which were treated with the strongest Antinonnin and carbolic acid showed about 50 per cent of the mites dead. On August 20 following the bushes which were treated with the strongest Antinonnin and strongest carbolic acid were reported to be free from mites. In all other cases the mites were found to be swarming with the single exception of bushes treated with turpentine. The success with turpentine, Antinonnin, and carbolic acid was, however, only apparent, since the currant bushes were killed by the insecticides. Currant bushes sprayed with the strongest

solution of calcium sulphid were badly affected. Petroleum emulsion was less injurious than any of the other insecticides. In cases where the bushes were lifted and dipped in solutions of carbolic acid or calcium sulphid of various strengths, the results were equally unpromising.

Another series of experiments was carried on from December, 1898, to October, 1899. Each experiment involved 60 currant bushes, half of which were Baldwins and half Black Naples. The substances employed in these experiments were undiluted methylated spirits, naphtha and saturated solutions of naphthaline in naphtha, formalin in 2, 0.5, and 0.1 per cent solutions, undiluted kerosene, and kerosene emulsion in 2 strengths. In none of these experiments did the insecticide treatment have any effect on the mites. No appreciable effect on the foliage was produced by the methylated spirits, naphtha, naphthaline, or formalin. In the use of kerosene emulsion it was noted that so long as weaker grades were used, the injury to the foliage was greater as the strength of the solution increased. When much greater strengths were used, there was much less injury, and in the case of pure petroleum there was no injury whatever to the foliage. The authors explain this result by the insolubility of kerosene in water, the coating of moisture on the leaves preventing it from coming into direct contact with the leaf tissue. An increase as well as a decrease in the strength of the kerosene emulsion beyond a certain point may render the emulsion less injurious to the foliage and also less destructive to insects.

A series of experiments was conducted for the purpose of determining whether this species of mite may not find shelter in the ground or about the roots of currant bushes as well as in the buds. The experiment showed conclusively that the mite does not hibernate anywhere except in the buds and that infestation may often be due to transportation of the mites by wind. The authors experimented with hydrocyanic-acid gas during which 1 oz. of potassium cyanid, 1 oz. of sulphuric acid, and 2 oz. of water were used for every 150 cubic feet of space. In order to confine the gas the plants were covered with a box which was inclosed with tarred felt. After this treatment the mites were found to be uninjured. Another insecticide, consisting of a solution of nicotin and camphor in diluted alcohol, was tried with negative results. Dipping currant bushes in water at various temperatures was found to furnish a rather efficient means for destroying the mites. A 5 minute immersion in water at 115° F. destroyed the adult mites but did not destroy the eggs. Higher temperatures, such as 140 or 160° F., were found to produce disastrous effects upon the currant bushes. A general inspection of infested bushes disclosed the fact that in any particular variety the infestation by mites was most pronounced in the strongest and healthiest bushes.

Of the varieties which the authors had under observation, Baldwin was perhaps most infested, while the Old Black was least infested. The authors conclude that until an immune variety is produced the best means of eradicating the pest appears to be wholesale cutting down of all bushes on any plantation which has become infested and burning them on the spot.

Bees and the fruit grower (*Jour. Jamaica Agr. Soc., 4 (1900), No. 5, pp. 285–287*).—A popular discussion of several problems concerning the relationship of bees to fruit.

Swarm catching and hiving, A. GALE (*Agr. Gaz. New South Wales, 11 (1900), No. 10, pp. 878–881*).—Practical notes on the habits of swarming in bees and on methods of securing and hiving swarms.

Races of Caucasian bees in connection with the general problem of the races of bees, G. A. KOZHEVNIKOVUIM (*Porodui karkozskikh pchel v svyazi k voprosu o porodakh pchel voobshche. St. Petersburg, 1900, pp. 24, pl. 1*).—The author discusses the peculiar characteristics of Caucasian varieties of bees as compared with many varieties of other regions.

Directions for the reeling of silkworm cocoons, V. P. IVONOV (*Nastavlenie k razmotkye kokonov. Tiflis, 1899, pp. 35*).

A list of works on North American entomology, N. BANKS (*U. S. Dept. Agr., Division of Entomology Bul. 24, n. ser., pp. 95*).—This bulletin contains a list of comprehensive works most useful for the study of North American insects; works on bibliography; and systematic works on single orders, including Hymenoptera, Diptera, Lepidoptera, Coleoptera, Hemiptera, Orthoptera, Neuroptera, Mallophaga, Thysanura, Myriapoda, and Arachnida; works on economic entomology; publications of the U. S. Entomological Commission and Division of Entomology; and important periodicals containing articles on entomology.

The asparagus fly and means of combating it, P. GRÜNDLER (*Atti Mem. Ital. R. Soc. Agr. Gorizia, n. ser., 40 (1900), No. 10, pp. 325–328, figs. 2; trans. from Landw. Ztschr. Oberösterr., 1900, No. 12*).—The asparagus fly (*Trypeta fulminans*) lays its eggs in the substance of young asparagus plants, especially under the scales. The larvæ which hatch from these eggs burrow in the substance of the plants. The treatment for these insects which is recommended by the author is spraying with Paris green.

Another enemy of the sugar cane (*Trinidad Bot. Dept. Bul. Misc. Inform. 25, 1900, p. 289*).—*Rhynchophorus palmarum*, commonly known as the palm beetle, is reported as attacking canes growing in the station grounds at St. Clair. The larvæ made a burrow completely through the cane from top to bottom, destroying all the soft inner portion. This beetle is rather common in Trinidad and usually attacks palms. It is not believed that the habit of injuring sugar canes will become general.

The principal insects affecting the tobacco plant, L. O. HOWARD (*U. S. Dept. Agr., Farmers' Bul. 120, pp. 32, figs. 25*).—A revised edition of the author's article in the Yearbook for 1898 (E. S. R., 11, pp. 471, 472).

Insects injurious to the apple tree with suggestions as to their control or extermination, J. M. SOUTHWICK (*Providence: Rhode Island State Bd. Agr., 1900, pp. 12*).—Brief popular notes on a considerable number of insects injurious to the apple tree.

The reappearance of the elephant beetle, W. W. FROGGATT (*Agr. Gaz. New South Wales, 11 (1900), No. 10, pp. 847–851*).—*Orthorrhinus cylindrirostris* is reported as injurious to grapevines, orange trees, apple trees, chestnuts, etc. The eggs are deposited in the substance of the bark. The larvæ upon hatching burrow downward into the main roots and then retrace their course to a point near where the egg was deposited and here pupate. Since there is no open passage into the burrow of this

insect, the remedies usually applied in such cases are not effective against the elephant beetle. Hand picking and jarring are to be relied upon to reduce the numbers of the beetle.

Practical suggestions for combating the coffee borer (*Planting Opinion, 5 (1900), No. 40, pp. 687–689*).—Planters usually adopt a method of cultivating shade to protect coffee plants against the attacks of *Xylotrechus quadrupes*. If affected coffee trees are to be burned for the purpose of destroying the insect, this measure should be adopted before the insect has escaped, or previous to April 15. The author recommends that the adult insects should be caught by systematic efforts extending over the whole season during which they may be found. It is also recommended that the stems of coffee bushes be scraped and cleaned. The borer requires fissures in the bark for the purpose of depositing its eggs, and egg laying would thus be rendered difficult by making the surface smooth.

Calcium carbid as a remedy for phylloxera, F. VASSILIÈRE (*Bul. Agr. Algérie et Tunisie, 6 (1900), No. 18, pp. 538, 539*).—From experiments made by the author it is concluded that calcium carbid applied at the base of the grapevine in the form of powder, or in small fragments, constitutes a very valuable remedy against phylloxera.

On the cause of the resistance of American vines to phylloxera, V. PEGLION (*Atti R. Accad. Econ. Agr. Georg. Firenze, 4. ser., 23 (1900), No. 2, pp. 183–241*).—This article constitutes an historical and critical discussion of American vines in America, the hereditary transmission of resisting power to phylloxera, injuries of the root system in relation to the resisting power, and the determination of the degree of resistance. A bibliography of the subject is appended.

The gall of the Monterey pine, W. A. CANNON (*Amer. Nat., 34 (1900), No 406, pp. 801–810, figs. 6*).—*Pinus radiata* growing on the grounds of the Leland Stanford Junior University was severely attacked by a species of gall gnat. The gall consisted of a malformation of the leaves. The gnat larvæ were found in pockets of the swollen leaves, entirely surrounded by vegetable tissue. In the fall such leaves contain 4 or more larvæ. In February eggs were to be found deposited between the leaf fascicles, on the outside of the young shoots, and between the scales. In consequence of the presence of the larvæ, the epidermis of the scales and leaves was modified in structure and function. The hypertrophy of the vegetable tissue was apparently not caused by any substance deposited with the eggs.

A contribution to our knowledge of the spiders of Victoria, including some new species and genera, H. R. HOGG (*Proc. Roy. Soc. Victoria, 13 (1900), No. 1, pp. 68–123, pls. 5*).—Brief biological and economic notes on a number of species of spiders, together with descriptions of new species.

Regulations of foreign governments regarding importation of American plants, trees, and fruits, L. O. HOWARD (*U. S. Dept. Agr., Division of Entomology Circ. 41, 2. ser., pp. 4*).—This circular contains a brief statement of the requirements regarding shipments from America to Austria-Hungary, Belgium, British Columbia, Canada, Cape of Good Hope, France, Germany, Netherlands, New Zealand, Switzerland, and Turkey. A list is given of places at boundary lines of different countries where plants may be introduced.

Physiological test of hydrocyanic-acid gas on strawberry plants, G. H. POWELL (*Delaware Sta. Rpt. 1899, pp. 162, 163*).—Experiments were made for the purpose of determining the effect of hydrocyanic-acid gas on strawberry plants, during which 1,500 Brandywine and Bubach strawberry plants were fumigated in a box containing 60 cubic feet of space. At the time of treatment the plants were moist. The period immediately succeeding the setting of the plants was unusually hot and dry. The results of the experiments indicate a slight injury to all the plants. The application of 0.1 or 0.2 gm. of cyanid of potash per cubic foot for 10 minutes did but little harm.

FOODS—ANIMAL PRODUCTION.

A report of investigations on the digestibility and nutritive value of bread, C. D. WOODS and L. H. MERRILL (*U. S. Dept. Agr., Office of Experiment Stations Bul. 85, pp. 51*).—The authors report the details of a number of experiments with healthy men on the digestibility of white bread, whole-wheat bread and graham bread. In some cases the bread was eaten alone, in others materials such as milk, sugar and butter were eaten in addition. With a view to learning the actual amount of nutrients digested, 2 methods of studying the metabolic products in the feces were investigated, namely, (1) treatment with a pepsin solution, and (2) with ether, alcohol, hot water and cold limewater. The metabolic nitrogen in the feces on a carbohydrate diet and during fasting was also studied. Artificial digestion experiments with 3 sorts of bread were made; the value of skim milk *v.* water in bread making was tested, and the loss of materials in bread making was investigated. The average coefficients of digestibility of the different sorts of bread and the digestibility of protein as shown in the artificial digestion experiments and when corrections are made by the 2 methods of estimating the metabolic products are shown in the table which follows:

Average digestibility of bread of different kinds.

	Total organic matter.	Protein.				Fat.	Carbohydrates.	Heat of combustion.
		Natural digestion.	Artificial digestion.	Natural, corrected by method 1.	Natural, corrected by method 2.			
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
White bread	96.0	85.41	93.26	94.72	90.67	73.5	98.3	91.1
Entire wheat bread	95.7	88.63	91.49	96.22	90.37	57.8	97.2	89.6
Graham bread	91.0	77.02	86.97	91.58	83.88	58.1	92.4	84.4

When skim milk and water were compared for bread making, it was found that the skim-milk bread contained somewhat more protein than the water bread. As shown by methods of artificial digestion there was little difference in the 2 sorts of bread. The results obtained in studying the losses of material in bread making are not discussed at length.

Experiments on the preservation of meat and fish with salts, E. PETTERSSON (*Arch. Hyg., 37 (1900), No. 2-3, pp. 171-238*).—Bacteriological studies are reported of meat and fish preserved with different strength solutions of salt, saltpeter, boric acid, and borax. The experiments are discussed in detail. Among the conclusions are the following: The principal effects of common salt as a general preservative are the retarding of the growth of micro-organisms, hindering even when present in a weak solution the deep-seated decomposi-

tion of protein, and the diminution of the chemical activity of certain micro-organisms.

Saltpeter, even when mixed with a small quantity of salt, prevents for a long time the formation of hydrogen sulphid, and, therefore, in the author's opinion, is useful in pickling meat and fish. Boric acid was found to be a satisfactory means of checking the growth of rod-like forms and cocci. However, it did not check the growth of yeasts. Borax was found to be a very active agent for checking bacterial growth. Even when mixed in small quantity with salt it materially increased the keeping quality of the materials preserved. For other reasons, however, the author does not recommend the use of borax and boric acid.

Contribution to the estimation of assimilable protein in feeding stuffs, K. Bulow (*Jour. Landw.*, *48* (*1900*), *No. 1*, *pp. 1-38*).—In order to study the true digestibility of nitrogen, digestion experiments were made with sheep by the usual method, and the feces were treated by the Kühn method of artificial digestion with pepsin and by the Stutzer method with pepsin and trypsin. The different feeding stuffs were also digested artificially by the Kühn and Stutzer methods. The effect on digestibility of rapid drying of feeding stuffs was also tested. The following table summarizes the average results of the different tests:

Digestibility of nitrogen of feeding stuffs estimated by different methods.

Feeding stuffs.	Total nitrogen.					Albuminoid nitrogen.				
	Apparent digestibility.	Digestion as corrected by—		Artificial digestion by—		Apparent digestibility.	Digestion as corrected by—		Artificial digestion by—	
		Pepsin method.	Trypsin method.	Pepsin method.	Trypsin method.		Pepsin method.	Trypsin method.	Pepsin method.	Trypsin method.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Meadow hay No. 1	51.35	69.32	83.05	66.92	77.69	39.74	62.04	79.03	59.05	72.38
Meadow hay No. 2	53.33	72.07	86.48	67.15	80.29	45.83	67.57	84.31	61.86	77.12
Clover hay	65.21	79.06	88.34	76.02	84.55	48.43	68.96	82.72	64.46	77.11
Wheat bran	74.05	88.74	89.85	90.21	92.31	68.42	86.23	87.70	88.14	90.68
Meat meal	95.16	97.41	99.02	95.47	97.99	94.97	97.25	98.98	95.26	97.89
Poppy-seed cake	87.39	93.62	95.60	88.60	92.55	85.49	92.66	94.89	86.89	91.43

The author's principal conclusions follow: Treating samples of feeding stuffs and feces with pepsin solution according to Kühn's method rendered the maximum amount of available protein soluble. A portion of the nitrogen remaining after such treatment is rendered soluble by an alkaline trypsin solution. Drying the feeding stuffs renders a portion of the protein insoluble in digestive juices; therefore the drying of feeding stuffs before samples can be ground for analysis should be conducted at a temperature not exceeding from 55 to 60° C. The results of the Stutzer-Pfeiffer method of estimating the digestibility of protein does not agree with the results obtained in actual experiments with animals. The pepsin-trypsin method gives too high results.

while those obtained under experimental conditions with only 250 cc. of pepsin solution were too low. The Kühn method of artificial digestion, on the other hand, shows the amount of protein which is actually soluble in the intestinal tract. This method does not do away with the necessity of natural digestion experiments, but is of value when rapid results are desirable, and under other conditions. The accuracy of the Kühn method has been shown by comparison with results of experiments with ruminants. Whether the method is equally applicable for comparison with mammals, especially man, must be determined by additional experiments.

Forage value [of the Golden Vine field pea] (*Utah Sta. Bul. 69, pp. 328–340*).—Artificial digestion experiments were made with the whole plant, leaves, stalk, and flower, of the Golden Vine field pea, and the results discussed, as well as the food value of this plant and other related topics. The digestibility of the protein of the whole plant varied from 68.21 to 73.99 per cent; that of the albuminoids, from 56.57 to 63.07 per cent. The digestibility of the protein of the leaves varied from 65.05 to 75.95 per cent; that of the albuminoids, from 56.55 to 63.82 per cent. The range in digestibility of the protein in the stalks was from 61.03 to 80.22 per cent; that of the albuminoids, from 49.51 to 62.18 per cent. In the case of the flowers, the digestibility of the protein ranged from 62.68 to 81.88 per cent; that of the albuminoids, from 59.02 to 78.88 per cent.

According to the author the digestibility of albuminoids is practically the same in the whole plant, leaves, and stalks. When just coming into flower, the coefficient of digestibility of this constituent is about 62, the greatest variation being about 4.8 per cent in the whole plant, 5.7 per cent for the leaves, 12.7 per cent in the stalks, and 19.86 per cent in the flowers and pods. The total protein is more digestible than the albuminoids and the variation is also greater. In the whole plant the variation is about 7 or 8 per cent; in the leaves, 10.9 per cent; in the stalks, 19.2 per cent, and in the flower and pods, 19.2 per cent. The leaves were found to contain 7.68 per cent nuclein; the stalks, 2.56 per cent. The protein of the Golden Vine field pea is considered slightly more digestible than that of alfalfa, being most digestible when the plant is just coming into flower. It is more digestible in the stalks than in the leaves. In the flowers a great increase in digestibility of protein occurred simultaneously with an increase in percentage of nitrogen-free extract. Pound for pound pea-vine hay appears to be more valuable than lucern hay. The facts point to early bloom as being the most suitable time to cure for hay. The loss of nutrients, especially protein, after early bloom is very conspicuous.

Feeding with Florida feed stuffs, H. E. STOCKBRIDGE (*Florida Sta. Bul. 55, pp. 215–308, pls. 11, figs. 2, dgms. 2*).—The conditions

which govern stock feeding in Florida are described, the general principles of feeding discussed, and feeding tests reported with steers and pigs and on the digestibility of cassava by a steer. Some Florida feeding stuffs were compared with 3 lots of local range steers and 1 lot of 3 grade steers. Lots 1 and 4, the latter being grade steers, were fed hay, cotton-seed meal, and cassava, about in the proportion of 2:1:7, the ration containing 36 lbs. of cassava per thousand pounds live weight. Lot 2 was fed cotton-seed hulls and meal, 5:1, while lot 3 was fed hay (either pea vine, or a mixture of crabgrass, beggar weed, and cowpea), cotton-seed hulls, wheat bran, and corn meal 3:7:8:7. In 70 days the average daily gains made by the 4 lots were, 2.43, 2.41, 1.95, and 1.83 lbs., respectively. The steers were slaughtered, the dressed weight of the 4 lots being 56.23, 54.55, 54.31, and 55.78 per cent, respectively, of the live weight, the hind quarters constituting in the several cases, 46.36, 49.39, 48.10, and 46.78 per cent of the total dressed weight. It is said that the beef was considered excellent in a local market where it was sold. The profits per lot were $28.75, $23.81, $11.57, and $25.41, respectively.

The authors point out that the greatest gains were made on the rations containing cassava, and that the native grade steers made greater gains than grade animals, although the latter furnished the largest proportion of hind quarters and the heaviest net weight.

In the feeding test with pigs 4 lots (1 lot containing 1 animal, the others 4 each), of Florida razor-back pigs, and 1 lot of 4 crossbred animals were used. Lots 1 and 2 (the former being the crossbred pigs) were fed cassava, wheat middlings, and cowpeas, 4:2:1.5; lot 3, corn and wheat middlings, 2:3; lot 4, sweet potatoes and wheat midlings, 1:1, while lot 5 was fed corn only. All the pigs weighed not far from 100 lbs. each at the beginning of the test and in 45 days the total gain per pig in the 5 lots was, 72.8, 32.5, 40, 31.6, and 25.9 per cent, respectively; the cost of the gains in the several cases being, lot 1, 2.9; lot 2, 3.1; lots 3 and 4, 5.6 each, and lot 5, 7 cts. The dressed weight ranged from 65.63 per cent of the live weight in the case of lot 5 to 77.53 per cent in the case of lot 1. According to the author, although the results were favorable for fattening razor-back pigs, yet greater gains were made by the blooded pigs. Corn was regarded as a good feeding stuff, but was most satisfactory when given in combination with other feeds.

The digestibility of cassava was tested with a steer on a ration made up of this material, cotton-seed hulls, and cotton-seed meal, about in the proportion of 12:5:1. The usual methods were followed. From the digestibility of the ration as a whole the digestibility of cassava alone was calculated to be as follows: Dry matter 52.12, protein 24.06, fat 59.28, nitrogen free extract 55.47, crude fiber 79.87, and ash 64.96 per cent.

Food and its relation to health, H. SNYDER (*Farm Students' Rev., 5 (1900), No. 96, pp. 83, 84*).—A general article. Among other points, the author discusses the length of time required to digest foods and the desirability of consuming a mixture of slowly and rapidly digesting foods.

Sugar as food, G. H. MURPHY (*U. S. Consular Rpts., 63 (1900), No. 238, pp. 321-324*).—A brief statement based on some of the recent European work on the food value of sugar.

Nutritive value of alcohol, W. O. ATWATER (*Harper's Mo. Mag., 101 (1900), No. 605, pp. 675-684*).—The problem of the nutritive value of alcohol is discussed, the important work of earlier investigators cited, and the author's recent experiments with the respiration calorimeter described in a popular way. Since alcohol is a source of energy in the body, the author considers it a food.

The food value of milk proteids; their properties and use for different preparations, with especial reference to "Eulactol," H. LURIG (*Molk. Ztg., 14 (1900), Nos. 29, pp. 493-495; 30, pp. 509-511*).—The value of foods prepared from milk proteids is discussed and an experiment with man reported on the digestibility of "Eulactol" when forming part of a mixed diet.

A new skim milk product [Nutrium], (*Farm Students' Rev., 5 (1900), No. 6, p. 94*).—A food product called "Nutrium" made from skim milk, evaporated and ground is described and an analysis given.

The iron content of egg yolk, SCHMIDT (*Ztschr. Angew. Chem., 1900, No. 28, p. 705*).—It is reported that the iron content of egg yolk was increased by feeding iron saccharate to hens, and it is claimed that the iron so incorporated in the eggs is more assimilable than most iron preparations.

Preserving eggs, E. F. LADD (*North Dakota Sta. Bul., 44, pp. 571-574*).—The success attending the preservation of eggs with water glass led the author to reprint an earlier publication of the station (E. S. R., 11, p. 279) on the subject, with a brief introductory statement.

Eggs in cold storage, J. STEPHENSON (*Agr. Gaz. New South Wales, 11 (1900), No. 7, pp. 551-555*).—Methods and results of storing eggs in the Government export stations of New South Wales are treated of.

On the preservation of fresh eggs, H. BORNTRAEGER (*Oesterr. Chem. Ztg., 3 (1900), No. 12, p. 295*).—The author reports the examination of eggs which had been spoiled by an attempt at preservation in weak (10° Bé) water glass solution which was, however, very alkaline. The eggs absorbed water glass, which rendered the white and part of the yolk gelatinous and as translucent as horn.

The utilization of fruit in Germany (*Sci. Amer. Sup., 50 (1900), No. 1282, p. 20549*).—This article is based on a consular report discussing the food of the German people, the increasing use of fruit, and the manufacture and regulations governing the production of jams and marmalade.

Compressed yeast—a study of the Boston yeast supply, C. W. PERLEY (*Amer. Kitchen Mag., 13 (1900), No. 2, pp. 43-48*).—The author examined a number of samples of compressed yeast and determined the amount of carbon dioxid produced by each, the relative number of yeast plants present, and the quality of bread made from different samples of yeast.

Food adulteration in Europe, J. T. DUBOIS (*U. S. Consular Rpts., 63 (1900), No. 238, pp. 316-320*).—The adulteration of a number of the more common food materials in Europe is discussed.

Food preservatives and coloring matters in food, A. S. GRÜNBAUM (*British Med. Jour., 1900, No. 2068, pp. 424, 425*).—An address before the sixty-eighth meeting of the British Medical Association, Ipswich, 1900.

The use and abuse of food preservatives, S. RIDEAL (*Sci. Amer. Sup., 49 (1900), No. 1270, pp. 20363-20366*).—A general discussion which summarizes much experimental work of the author and other investigators. Reprinted from the *Journal of the London Society of Arts.*

The value of grape marc as a feeding stuff, L. DEGRULLY (*Prog. Agr. et Vit. (Éd. L'Est), 21 (1900), No. 39, pp. 389-392*).—The composition of grape marc or pomace is quoted and information on the value of this material as a feeding stuff is summarized.

The significance of carbohydrates in muscle, F. S. LEE and C. C. HARROLD (*Science, n. ser., 11 (1900), No. 285, p. 952*).—Abstract of a paper presented before the New York Academy of Science, Section of Biology, May 14, 1900.

The influence of experimental modifications of the organism on the consumption of glucose, A. CHARRIN and A. GUILLEMONAT (*Compt. Rend. Acad. Sci. Paris, 131 (1900), No. 2, pp. 126-128*).—Experiments with rabbits are reported on the effect of injecting subcutaneously vegetable acids, mineral acids, and sugar solutions.

Concerning metabolism in the horse, T. PFEIFFER (*Landw. Vers. Stat., 54 (1900), No. 1-2, pp. 101-112*).—A controversial article.

Sheep and wool: A review of the progress of American sheep husbandry, J. R. DODGE (*U. S. Dept. Agr., Rpt. 66, pp. 63, figs. 3*).—The author reviews the history and development of the sheep industry in this country, tracing the history of domestic wool, variations in price, and other questions of commercial importance.

Principles of breeding, A. A. BRIGHAM (*Rhode Island Sta. Rpt. 1899, pp. 182-198*).—A descriptive popular article on poultry breeding.

About foods and feeding, S. BEALE (*Country Gent., 15 (1900), Nos. 2463, p. 305; 2464, p. 325*).—A general article on poultry feeding.

On the breeding, care, and agricultural value of guinea fowl, E. S. ZÜRN (*Fühling's Landw. Ztg., 49 (1900), Nos. 9, pp. 337-340; 10, pp. 372-375*).—A general discussion.

DAIRY FARMING—DAIRYING.

Experiments with dairy cows, F. B. LINFIELD (*Utah Sta. Bul. 68, pp. 167-309, figs. 7, dgms. 9*).—*A study of the records of the dairy herd for 5 years* (pp. 167-237).—The dairy herd consisted of from 7 to 15 grade cows each year for the 5 years. During this time a record of 23 cows for one year or more was obtained. Some of the more important data are summarized in the following table:

Average annual record of dairy herd.

Cow.	Weight of cows.	Time in herd.	Lactation period.	Cost of food.	Yield of milk.	Fat content of milk.	Yield of butter fat.	Yield of butter.	Net returns with butter fat at 16 cts. per pound.
	Pounds.	*Years.*	*Days.*		*Pounds.*	*Per ct.*	*Pounds.*	*Pounds.*	
No. 1	1,332	5	288	$21.81	5,813	3.2	186.3	217.8	$8.61
No. 2	1,126	2	303	21.24	5,818	3.89	226.2	264.5	15.03
No. 3	1,029	2	295	21.94	5,962	4.6	272.8	320.6	22.03
No. 4	1,032	2	326	23.70	5,477	4.9	267.9	312.6	19.20
No. 6	993	3	331	19.32	3,931	3.78	148.9	174.4	4.50
No. 7	979	3	328	22.46	5,282	4.29	226.6	263.7	13.79
No. 8	1,116	4	358	24.16	7,282	4.31	314.5	367.0	22.79
No. 9	1,015	4	337	20.64	5,956	4.41	262.0	305.7	18.84
No. 10	1,048	2	346	24.22	5,335	4.07	217.5	253.8	10.58
No. 11	1,057	5	331	20.07	5,569	4.14	230.7	269.2	16.84
No. 12	980	2	353	23.43	5,409	4.1	223.9	261.3	12.41
No. 13	1,145	5	339	21.83	6,539	4.11	269.0	315.9	21.21
No. 15	755	1	338	22.22	5,502	4.73	260.5	303.9	19.46
No. 17	874	2	365	18.54	4,584	4.44	203.7	237.6	14.05
No. 18	986	2	328	19.49	4,218	4.83	204.3	238.3	13.20
No. 21	1,063	2	277	21.13	7,254	3.73	271.3	316.5	22.28
No. 22	966	1	320	21.69	6,862	4.04	277.4	323.7	22.70
No. 23	863	1	365	17.91	4,035	5.02	202.5	236.3	14.50
Average	1,020	....	329	21.43	5,601	4.23	237.0	276.5	16.20

Excluding the 2 poorest cows, Nos. 1 and 6, and 3 heifers, Nos. 17, 18, and 23, the remaining 13 cows gave an average yearly production of 6,019 lbs. of milk and 255.4 lbs. of butter fat, the average returns per cow being $18.24 over an average cost for food of $22.21.

A summary of the records by years shows an increase in the average production from 268.6 lbs. of butter in 1894–95 to 286.8 lbs. in 1898–99, with a decrease in the cost of production of 1 lb. of butter from 8.67 to 7.3 cts. These results are attributed to good feed and care, the use of cheaper feeding stuffs, an improvement in the herd due to breeding, and the elimination of a few unprofitable cows.

A study was made of the influence of the weight of the cow, period of lactation, dehorning, methods of feeding, type, and change of milkers upon the yield and quality of milk and the economy of production. Some of the author's conclusions are as follows:

"In the majority of instances the largest production was associated with the lowest live weight, while the least production was associated with the highest weight. A tendency to lay on flesh, therefore, would appear to be opposed to the largest dairy production. . . .

"As the period of actation advanced the cows decreased in their milk yield about 9 per cent each month. The percentage of fat in the milk increased slightly, more particularly after the sixth month of lactation.

"The effect of turning cows from dry feed to fresh spring pasture was to increase markedly the yield of milk and butter fat and to increase slightly the percentage of fat in the milk. . . . Fresh milch cows gave the greatest increase in yield of milk and butter fat when turned to pasture, but the test of the milk was not affected. . . . Cows changed from dry to green feed in the stable did not give an increase in production like cows turned to pasture. It would seem, therefore, that the increase in production following from the pasture feeding is due mainly to the change in the habits of the cow and in the manner of gathering her food.

"Cows bred to drop their calves during the early winter season, when turned to pasture gave nearly as large a production as when they came in fresh, and they maintained the increased flow on pasture longer than cows that came in at other times. . . .

"A change of milkers may not, as a rule, be advisable, yet a change from a poor to a good milker, even though the good milker was a stranger, showed an immediate increase in milk yield."

Dehorning had no marked effect upon milk production. In a discussion of the type of cow in relation to dairy production, brief descriptions and illustrations from photographs are given of 7 of the cows of the herd.

Data are given showing the variations in the different constituents of the milk of a number of cows, and methods of testing cows and sampling milk at creameries are discussed. "The cows, as a rule, gave less but richer milk from the shorter milking period in the day. . . . The daily variations in the composition of the milk of a cow, the variations from morning to evening, and in the first, last, and average milk, are variations in fat only, and do not, as a rule, extend to the other solids."

Winter feeding experiments (pp. 239–265).—One feeding test was made each winter for 4 years. The first test included 9 cows and covered 24 weeks, and the remaining tests included 4 cows each and covered 16, 19, and 16 weeks, respectively. In each test a comparison was made between alfalfa alone and alfalfa and corn fodder. Different quantities of grain, ranging from 4 to 8 lbs., were fed daily in the different tests. The nutritive ratio of the alfalfa ration was 1:4.6, and of the alfalfa and corn fodder ration 1:6. The results are tabulated and discussed. There was a waste of about 10 per cent in feeding lucern and 25 per cent in feeding corn fodder. The cows gained slightly in weight on the alfalfa ration and lost on the alfalfa and corn fodder ration.

"Calculated from the amount eaten, the ration of alfalfa and corn fodder produced milk and butter fat for a little less outlay in dry matter than the ration of alfalfa, but calculated from the amount fed there was practically no difference. Considering the cost of production, and charging the cows with the amount fed, the corn fodder ration was a little the more costly, but the difference was small . . . The cost of producing milk and butter fat varied according to the amount of grain fed. The ration containing the smallest amount of grain was the most economical. . . . The wider ratio required less dry matter to produce 1 lb. of butter fat, or 100 lbs. of milk."

Summer feeding experiments (pp. 267–305).—One test was made each year for 4 years to compare soiling and pasturing. In all 9 cows were pastured for about 16 weeks and 9 were fed in the stable on soiling crops for the same time. The pasture-fed cows produced on the average more milk and fat and made a greater gain in live weight than the cows fed in the stable. The flow of milk, however, was not so evenly maintained during the whole period.

A comparison was made in 5 experiments of the results obtained from 1 acre of land when the crop was pastured and when it was soiled.

"One acre of soiling crops furnished feed for 2 cows for 108 days, produced 3,145 lbs. of milk and 147.9 lbs. of butter fat, valued at $23.67. One acre of pasture furnished feed for 2 cows for 102 days, and produced 4,047 lbs. of milk and 189.8 lbs. of butter fat, valued at $30.37. This shows an advantage of $6.50 in favor of the acre of land used as a pasture compared with the same area used for soiling crops. These results are not conclusive, however, for the soiling crops."

The effect of feeding grain to cows on pasture was studied during 4 years. In all 28 cows were used in the tests, 14 of which were fed 4 lbs. of grain per head daily. The records of the cows fed grain were compared with those of the cows on pasture alone, for the 4 months each summer during which the grain was fed, and also for the 4 months following during which all the cows were fed alike.

"The cows which received grain while on pasture produced more milk and butter fat than those not receiving grain, yet not enough extra to pay for the grain fed. The cows fed the grain on pasture maintained their flow of milk better throughout the milking season than did those not receiving grain, and thus during the fall

months they produced considerably more than the cows not fed grain—enough more to more than pay for the grain fed."

Notes are given on the nature of the pasture used in the experiments, on the management of cows on pasture in relation to bloat, and on the relative effects of soiling and pasturing on lucern and mixed grasses.

The composition of human milk, BACKHAUS and W. CRONHEIM (*Ber. Landw. Inst. Univ. Königsberg, 5 (1900), pp. 61–73*).—Analyses of 12 samples are reported, made in connection with an investigation of the best method of modifying milk for infants' use. The results are compared with those of Camerer and Söldner. In agreement with these investigators it was found that there was a discrepancy between the total solids and the sum of the constituents of the total solids as determined separately, amounting to from 0.68 to 2.045 per cent. This is held to represent an unknown constituent which passes into the filtrate when the albuminoids are precipitated with alcohol. Various attempts were made to determine the character of this substance, and the means of isolating it.

Two complete ash analyses of human milk are given. These showed 14.79 and 11.75 per cent of phosphoric acid, 17.36 and 15.52 per cent of calcium oxid, and 33.74 and 27.33 per cent of potassium oxid, respectively. These data are said to be higher in potash and lower in phosphoric acid and calcium oxid than the generally accepted average, for the ash of cows' milk which has been used in making modified milk.

On the composition of Danish butter, H. FABER (*Analyst, 25 (1900), Aug., pp. 199–201*).—Data obtained in connection with the butter shows in Copenhagen are given for 12,000 samples of milk during 9 years. "The average is about 14 per cent [of water], most samples having from 13 to 15 and very few less than 12 per cent or more than 16 per cent." Analyses of Danish butter imported into England during 1898 and 1899 are given by months, the Reichert-Wollny figure, index of refraction, and Beechi test being reported.

"In Denmark cows are generally housed from the middle of October to the middle of May, and the calving takes place in autumn and winter. Correspondingly, we find the Reichert-Wollny figure higher in the winter and spring than in summer, and lowest in the autumn, the maxima (32.6 and 32.5) for the 2 years occurring in March, the minima (24.3 and 25.6) in October. The effect of moving the cows from cold fields to warm byres in October, additional to the increased number of of new-calved cows, finds its expression in a rapid rise in the Reichert-Wollny figure from October to November."

The effect of food and of the individuality of the cow on the taste of milk and its tolerance, BACKHAUS (*Ber. Landw. Inst. Univ. Königsberg, 5 (1900), pp. 110–126*).—Cows were given a number of different sorts of coloring matters, condiments, lactic and butyric acids, etc., and the effect noticed upon the color and taste of the milk

and the manner in which it agreed with people. A number of feeding stuffs were also tested. In no case was the taste or the tolerance of the milk affected by feeding large quantities of caraway, fennel, anise, gentian, onion, lactic acid, or butyric acid. Methyl violet was transmitted from the food to the milk, but most other coloring matters gave negative results. An undesirable taste in the milk of some cows was not corrected by changing the food or giving large quantities of ground oats. No disturbances in the agreement of the milk with the children receiving it could be attributed to changes in the food, and none of the feeding stuffs used, including cotton-seed meal, palm-nut cake, and sesame cake, imparted any taste to the milk; neither did these make any material change in the fat content of the milk. The milk of individual cows was found to differ considerably in taste and in the way in which it agreed with children. The milk of some cows was considerably off flavor, the reason for this being attributed to special chemical properties of the constituents and the presence of unorganized ferments. In practice it is recommended to use the milk as quickly as practicable and to employ mixed milk from a large number of animals in order to diminish as far as possible any objectionable quality.

The production of aseptic milk, BACKHAUS and O. APPEL (*Ber. Landw. Inst. Univ. Königsberg, 5 (1900), pp. 73–102*).—This was largely a bacteriological study of the organisms in milk produced under various conditions. It was found possible, by the observance of every precaution in the care of stables and handling of the cows and the milk, to produce milk of relatively low germ content. A number of factors which influence this are noted. The germ content was found to be much larger in summer than in winter. Bacteria multiplied more rapidly in wooden buckets than in tin cans, but in the case of new buckets tannin was believed to check the action after a time. The germ content was not increased by feeding green fodder. Better results were obtained with hand milking than with the use of milking tubes, the latter giving a higher germ content at 4 different stages of the milking. A considerable number of trials with fractional milking showed the germ content to decrease regularly as the milking progressed, and in a few cases the last portion was sterile. The former recommendation to separate the first quarter from the last three-quarters is confirmed. As the result of fractional milkings the authors conclude that the milk in the udder of healthy cows is sterile. Sterile milk and water introduced into the udder suffered no change, and it is believed that the conditions within the udder are unfavorable to the life of the germs most commonly found in milk.

The Cambridge Sentinel milk sterilizer (*Jour. Expt. Med., 4 (1899), No. 2, p. 217; abs. in Nature, 63 (1900), No. 1624, p. 166*).—This is a simple sterilizer made for domestic use. In one form a bell

rings automatically when a temperature of 85° C. is reached; in another the gas is turned off at that temperature. The automatic mechanism is actuated by the melting of an easily fusible alloy. Tests of the apparatus indicated that there was considerable difference in the temperature at which the automatic apparatus worked, due to the amount of liquid in the sterilizer. With a small quantity the bell or cut-off did not work until a temperature of over 95° was reached. The criticism is made that a temperature of 85° is higher than is necessary, 65 to 68° C. continued for 20 minutes being sufficient.

Handling the dairy cow, C. F. CURTISS (*Chicago Dairy Produce, 7 (1901), No. 65, pp. 30, 31*).—Address on feeding and breeding before the Iowa State Dairy Association.

Bibliography of milk, H. DE ROTHSCHILD (*Bibliographia lactaria. Paris: Octave Doin, 1901, p. 584*).—This is a general bibliography of the subject of milk up to the close of 1899, with an introduction by E. Duclaux. It is the most extensive bibliography of the subject ever prepared, including 8,375 titles and dating back to the beginning of the sixteenth century. The titles are arranged by subjects, with entries in chronological order under each subject. An author index and a list of inventions and patents are also given. The subjects covered are the production, composition and properties, handling, bacteriology, adulteration, and utilization of milk as food. Butter and cheese are not included, but koumiss and kephir and condensed and modified milk are included.

The acidity of milk, P. VEITH and M. SIEGFELD (*Milch Ztg., 29 (1900), No. 38, pp. 593–597*).—From many investigations the conclusion is reached that the natural acidity of milk does not approach a fixed amount, but may show a wide variation. Evening's milk averaged a slightly higher acidity than morning's milk. The variations in acidity were not particularly marked during different portions of the year, but depend more upon the conditions of milking and handling.

Individual variations in milk secretion and the return for food eaten, BACKHAUS (*Ber. Landw. Inst. Univ. Königsberg, 5 (1900), pp. 103–109*).—This is an individual record for 10 cows. The relation of the milk production to the food units consumed and to the cost of food is brought out. The results show wide differences between cows in these respects and indicate very strongly the importance of testing cows, as previously advocated by the author.

Some experiments on the production of acetic acid in milk by lactic-acid bacteria, C. BARTHEL (*Centbl. Bakt. u. Par., 2. Abt., 6 (1900), No. 13, pp. 417–420*).—Experiments were made with skim milk inoculated with pure cultures of lactic acid bacteria, the flasks containing the milk being in some cases charged with carbonic acid and then sealed, and in others having a current of oxygen conducted through them. Acetic acid was produced under both conditions, although the amount was much larger in the presence of oxygen. The conditions most favorable to the production of acetic acid were found to be those which are known to be most favorable for the growth of lactic-acid bacteria.

Milk inspection, PETERS-HILTNER (*Chicago: Alex. Eger, 1901, pp. 96*).—A manual adapted to the needs of commercial analysts, market inspectors, and health officers. Methods of analysis are given and a bibliography appended.

Rennet action and rennet testing, P. VEITH and M. SIEGFELD (*Milch Ztg., 29 (1900), Nos. 42, pp. 657–659; 43, pp. 673–675*).—Experiments are reported on the effect of acidity, and of soluble lime salts on the action of rennet and on the means of determining the strength of rennet. At present the only means is said to be an actual trial with milk.

Some lactic-acid bacteria found in ripe cheese, G. LEICHMANN and S. VON BAZAREWSKI (*Centbl. Bakt. u. Par., 2. Abt., 6 (1900), Nos. 8, pp. 245–253; 9, pp. 281–285; 10, pp. 314–331*).—In a study of the flora of ripe Emmenthaler, Chester, and Gouda cheese the authors isolated 5 forms which they designate provisionally as *Bacterium casei* I, II, III, and IV, and *Streptococcus casei*. The characteristics of these different forms and their behavior under a variety of conditions are described in detail.

VETERINARY SCIENCE AND PRACTICE.

Charbon, W. H. DALRYMPLE (*Louisiana Stas. Bul. 60, 2. ser., pp. 341–370*).—During the summer seasons of 1898 and 1899 anthrax prevailed in an epizootic form throughout the State. This disease has acquired an increased economic importance in the State on account of the recent extensive importation of valuable beef cattle. The author believes that the only method by which anthrax can be controlled or eradicated is by the combined effort of stockmen in the State, supported by a rigidly enforced law. The bulletin contains a copy of the British anthrax order which is considered by the author a good basis for a law against anthrax in Louisiana.

Detailed notes are given on a trip of inspection made through the State for the purpose of determining the extent of anthrax, the conditions under which infection takes place, and the sanitary measures adopted. In general it was found that the carcasses of animals which had died of anthrax were either not destroyed, or if so only after a considerable period had elapsed during which contagion might have been spread by flies and carnivorous animals. The author believes that the most important factors in the spread of anthrax in the State are the neglect to destroy diseased carcasses and the prevalence of horseflies. It is recommended that kerosene be spread upon the surface of pools visited by horseflies in order to destroy these insects. A few outbreaks of anthrax were apparently due to eating infected feeding stuffs, such as elevator feed and rice bran. Such contamination of feed is to be considered accidental and has no connection with any particular feeding stuff. The author states that gratifying results have followed the use of preventive vaccination where this method has been employed in the State.

Bacteriological work, F. D. CHESTER (*Delaware Sta. Rpt. 1899, pp. 30–33*).—The author gives a brief report on culture tests for anthrax in 4 suspected cases. A quantity of hog-cholera serum received from a pharmaceutical firm was used in laboratory experiments on guinea pigs. In order to determine the virulence of the culture of hog cholera, 5 guinea pigs were inoculated with varying quantities of a culture in neutral bouillon, with the result that the animals died in from 7 to 19 days. In another experiment 4 guinea pigs were inoculated each with 0.1 cc. of the culture and on the following day

3 of the animals received quantities of hog-cholera serum varying from 0.3 to 1 cc. The 3 animals treated with hog-cholera serum died in from 6 to 7 days. It was apparent from the experiment that this serum was too weak to be of value in the treatment of hog cholera.

Brief notes are added on bacteriology and post-mortem examinations of hogs in outbreaks of hog cholera.

Pleuro-pneumonia in dairy herds, M. A. O'CALLAGHAN (*Agr. Gaz. New South Wales, 11 (1900), No. 8, pp. 627-631*).—Pleuropneumonia is said to break out occasionally on a small scale among the dairy herds and other cattle of Australia. The author recommends that in all cases where any outbreak of the disease is suspected, the owner of the animals should take the temperatures of his whole herd twice a day. Any animals which show a temperature above 103° should be isolated at once from the herd in order to prevent the spread of the disease.

A method of preventive inoculation which is in common practice among stock raisers is to saturate cotton threads with the serous fluid taken from the pleuro cavity of diseased animals and to draw these threads under the skin near the end of the tail. The virus upon the threads has the effect of producing a mild form of the disease, which confers immunity against the fatal form.

The stomach worm (Strongylus contortus) in lambs, A. G. HOPKINS (*Jour. Comp. Med. and Vet. Arch., 21 (1900), No. 5, pp. 277, 278*).—This parasitic worm was found to be the cause of rapid emaciation, loss of weight, dullness, coughing, and other symptoms of disease in lambs. In the treatment of this disease tonics were administered with practically no results. The lambs were then divided into 2 lots. Lot 1 was given benzine in doses of 2 drams in 2 oz. of milk on 3 successive mornings, while lot 2 was given creolin in doses of 1 dram in 2 oz. of milk for the same length of time. This treatment was applied during fasting of the lambs. Previous to the treatment the lambs were losing weight. When weighed 10 days after the experiment, gains of from 2 to 5 lbs. were noted, which gains were also recorded at subsequent weighings which took place every 2 weeks. The medicines were administered as a drench.

Gruber's reaction in hog cholera, R. R. DINWIDDIE (*Jour. Comp. Med. and Vet. Arch., 21 (1900), No. 9, pp. 528-532*).—The observations recorded in this paper were confined chiefly to experimental animals, including rabbits, pigs, and guinea pigs. Nearly all tests were made with dried blood. Dilutions were made with sterile normal salt solution in the proportion of 1:10, 1:20, and 1:40. When only one slide was prepared for diagnostic purposes a dilution of 1:20 was found most reliable within the limits of half an hour. The blood of 26 rabbits with a dilution of 1:10 was tested with the result that no reaction was obtained in 22 cases. In the other 4 rabbits apparent

reactions were obtained which were not considered typical. No reaction was obtained with normal blood from 12 guinea pigs which were tested, and similar results were obtained from testing the normal blood of hogs. After inoculation with the hog-cholera bacillus the agglutinating property appears in the blood within from 4 to 6 days in rabbits, guinea pigs, pigs, and cattle. When inoculations are made with cultures of feeble virulence, the appearance of the agglutinating property in the blood is frequently delayed several days beyond the usual time. In animals which survived the inoculation the persistence of the agglutinating reaction seemed to depend upon the severity of the disease.

Rabies (*U. S. Dept. Agr., Bureau of Animal Industry Bul. 25, pp. 29*).—This bulletin contains a report of the Committee on Public Health of the Medical Society of the District of Columbia upon the general subject of rabies, with special reference to local conditions. The Medical Society of the District of Columbia, at a meeting held April 11, 1900, referred an investigation of the matter to the Committee on Public Health to recommend such action as might be considered advisable.

The main body of the report is controversial in nature, in which the position is taken that rabies is an acute specific disease due to a specific virus, and is produced ordinarily by the bite or saliva of an infected animal. It is stated that the Bureau of Animal Industry demonstrated by biological test in the District of Columbia 2 cases in 1895, 5 in 1896, 3 in 1897, 7 in 1898, 19 in 1899, and 15 up to the end of March, 1900. The committee gives a general discussion of the symptoms, period of incubation, diagnosis, rate of mortality, treatment, and methods of prevention of rabies. These subjects are further discussed in appendixes to the bulletin, and also the subject of the muzzle as a means of prevention.

An organism pathogenic to rats, J. DANYSZ (*Ann. Inst. Pasteur, 14 (1900), No. 4, pp. 193–201*).—A cocco bacillus which resembles *Bacillus coli* was isolated from an epidemic of field mice and was found to be slightly pathogenic to rats. A number of experiments conducted in feeding cultures of this bacillus to rats indicated that 2 or 3 out of every 10 rats thus fed ultimately died with a disease similar to that produced in mice by the same bacillus. It was found upon further experimentation that this bacillus became gradually weakened in its virulence in passing from rat to rat. Experimental passages of the bacillus through a series of rats demonstrated this fact, as well as the gradually decreasing mortality in the number of rats exposed to infection from this disease. From these results it was believed that the reason for the gradual diminution in virulence of the bacillus was to be found in the regular alternation of media from the intestine to the blood. The bacillus was carefully cultivated on a bouillon medium,

with the result that the virulence was considerably increased for rats. A number of cultures of increased virulence were then distributed in different cities, and experiments conducted in the destruction of rats. The results indicate that this organism furnishes an effective means for ridding cities of rats, but in no case can be relied upon to utterly exterminate the rats in any locality.

The prophylaxis of paludism (*Rev. Sci.* [*Paris*], *4. ser.*, *14* (*1900*), *No. 7, pp. 208–211*).—Brief notes on the biology of mosquito larvæ and a discussion of the methods for their destruction.

The propagation of the filariæ of the blood exclusively by means of the puncture of peculiar mosquitoes, B. GRASSI and G. NOÈ (*British Med. Jour., 1900, No. 2079, pp. 1306, 1307*).—Experiments by the authors demonstrated that the larvæ of filaria are found in *Anopheles claviger.* The larvæ of filaria sucked up with blood by the mosquitoes migrate into the Malphigian tubes, where they continue their development. At the completion of the larval development the larvæ pass into the body cavity, move forward toward the head, and collect in the prolongation of the body cavity within the labium. Experiments on dogs showed that when Anopheles bites these animals the larvæ pass out of the labium and are thus inoculated into the bitten animal.

The communicable diseases of domestic animals that materially affect the live-stock industry, W. C. RAYEN (*Jour. Comp. Med. and Vet. Arch., 21* (*1900*), *No. 3, pp. 134–139*).—Notes on tuberculosis, Texas fever, blackleg, and hog cholera.

The significance of atmospheric infection in the more important animal diseases and means for controlling the danger of such infection, K. KASSELMANN (*Ztschr. Tiermed., 4* (*1900*), *Nos. 2–3, pp. 124–142; 4, pp. 260–282; 5, pp. 321–343*).—An elaborate critical discussion of the literature of the subject with special reference to tuberculosis, glanders, anthrax, blackleg, rinderpest, sheep pox, contagious pleuropneumonia of cattle, influenza, swine plague, pneumonia of horses, and foot-and-mouth disease. In the general discussion of methods for preventing infection of domesticated animals through the air, the author classifies such measures into 3 groups: Those which tend to prevent the inhalation of micro-organisms in the air, those which prevent the entrance of micro-organisms into the atmosphere, and those which are concerned with destroying micro-organisms in the air. A bibliography of 80 titles is appended.

Colloidal silver, M. KLIMMER (*Ztschr. Tiermed., 4* (*1900*), *No. 4, pp. 289–300*).—From experiments with this substance in veterinary practice, the author concludes that colloidal silver is best administered with the addition of albumen, gelatin, or gum arabic, in order to protect it from the action of the salts which are found in animal fluids. Colloidal silver injected hypodermically in a physiological salt solution containing albumen is almost completely absorbed. When injected intravenously or hypodermically, it is for the most part excreted in feces. Colloidal silver injected intravenously produces an elevation of temperature in healthy and diseased horses. In the intestines it has only a very slight antiseptic effect.

The value of iodin-protein compounds in veterinary practice, RÖDER (*Arch. Wiss. u. Prakt. Thierh., 26* (*1900*), *No. 4–5, pp. 325–335*).—The author experimented with several forms of iodin-protein compounds in the treatment of diseases of animals. The results indicate that iodin has the same therapeutic effect when given in combination with protein, but does not have the harmful secondary effects which are noted when it is given alone. The author recommends iodin combined with protein for the treatment of actinomycosis.

Gangrenous sloughing of the tail of domestic animals, ELLINGER (*Berlin. Tierarztl. Wchnschr., 1900, No. 43, pp. 505–507*).—Various names have been given to

this disease, which consists in the death and falling off of the tip of the tail and sometimes the whole tail. It has been observed especially in cows and young pigs. The cause of the disease is not well understood, but apparently a number of causes might produce this affection of the tail. Among such causes may be mentioned mechanical injuries which result in the interruption of the blood circulation in the tail, the presence of ammonia vapor in unusual quantities, and ergot. The author reviews the literature relating to this subject and describes an outbreak of the disease among pigs in Roumania.

The clinical value of a leucocyte count in the diagnosis of septic infections, G. D. HEAD (*Jour. Comp. Med. and. Vet. Arch., 21 (1900), No. 3, pp. 129–134*).—Careful counts of the leucocytes in healthy dogs showed a variation of from 6,600 to 9,600 per cubic millimeter, with an average of about 8,000. The presence of septic infection causes a more or less pronounced leucocytosis. In dogs and rabbits a great increase in the number of leucocytes was noted during septic processes. In one case the number per cubic millimeter rose to 36,300 from a normal average of 9,200. Attention is called to the diagnostic value of a leucocyte count in veterinary practice.

Water hemlock poisoning, E. F. LADD (*North Dakota Sta. Bul. 44, pp. 563–569, fig. 1*).—On account of the unusual dryness of the season, it is reported that animals grazed in low marshy places more extensively than in ordinary years. Water hemlock is frequently found in such localities, and several cases of poisoning have been apparently traced to the action of this plant. In the case of 2 cows good evidence was obtained against water hemlock. An examination of the blood and stomach contents revealed the presence of the active principle of water hemlock.

The article contains a reprint of a previous paper on the same subject (E. S. R., 11, p. 287).

Poisoning from Glyceria spectabilis infested with Ustilago longissima, J. ERIKSSON (*Ztschr. Pflanzenkrank., 10 (1900), No. 1, pp. 15, 16*).—About 100 cattle fed with this grass developed symptoms of poisoning within 1½ hours after feeding. Nearly all of the animals recovered after about 3 hours. In another locality 3 cows ate a quantity of this grass and were affected so severely that the owner slaughtered them. The grass in both cases was badly smutted.

Treatment of tuberculosis by muscle plasma or zomotherapy, J. HÉRICOURT and C. RICHET (*Rev. Sci. [Paris], 4. ser., 13 (1900), No. 10, pp. 306–308*).—The authors conducted experiments upon 16 dogs with 18 other dogs as checks. The experiments showed that cooked meat did not have the same effect as raw meat upon tuberculous animals. The dogs were fed upon raw meat, and in nearly every case resisted the progress of the disease to a greater extent than did the checks, and in many cases final recovery took place.

Treatment of infectious diarrhoea of calves with tannoform, SCHÜMMHOF (*Berlin. Tierarztl. Wchnschr., 1900, No. 14, pp. 161, 162*).—Immediately after the birth of calves the author gave 0.05 gm. calomel mixed with sugar, and 15 minutes later 4 gm. tannoform mixed with sirup and meal. These doses were given 3 times on the first day, twice on the second day, and once on the third day. Fairly satisfactory results were obtained in checking the disease.

A review of contagious abortion, S. P. SMITH (*Jour. Comp. Med. and Vet. Arch., 21 (1900), No. 3, pp. 151–155*).—Brief historical notes on the development of the knowledge concerning this disease.

Schmidt's treatment of parturient paresis, A. G. ALVERSON (*Jour. Comp. Med. and Vet. Arch., 21 (1900), No. 3, pp. 168, 169*).—The author gives short notes on 6 cases in which he administered potassium iodid infusions with success in only one case.

Parturient paresis, A. H. HARTWIG (*Jour. Comp. Med. and Vet. Arch., 21 (1900), No. 3, pp. 142–145*).—The author reports results of applying the Schmidt method in the treatment of this disease. Detailed notes are given on 6 cases in which potassium iodid infusions were injected into the udder with recovery in 5 cases. In one case

which developed 8 weeks after calving and in which there were symptoms of mammitis, potassium iodid infusions were not given. The udder was subjected to friction, was frequently immersed in hot water, and was relieved of its contents as often as possible. The cow recovered.

Parturient apoplexy and its treatment, WITT (*Berlin. Tierarztl. Wchnschr. (1900), No. 22, pp. 253, 254*).—The author treated 57 cases of this disease by means of infusions of potassium iodid with recovery in 50 cases after from 6 to 12 hours. The author takes issue with Schmidt in his theory of the nature of the disease and the effect of the potassium iodid treatment. The author noted a relatively lax and soft condition of the udder in 80 per cent of the cows which were treated and a complete or nearly complete cessation of milk secretion in every case. It is believed, therefore, that the cerebral anemia observed in many cases of parturient apoplexy is not due to any increased blood pressure in the udder. The action of potassium iodid infusion has been explained as checking the secretion of milk. The author maintains, on the contrary, that whenever milk secretion is partly checked soon after calving parturient apoplexy is likely to be developed, and that the treatment of the disease consists in stimulating the udder to its customary secretory activity. The author believes that in ordinary cases recovery takes place very rapidly after milk secretion is resumed.

Is a post-mortem examination necessary in the diagnosis of anthrax, STEINBACH (*Berlin. Tierarztl. Wchnschr., 1900, No. 41, pp. 481, 482*).—According to the author's experience, a post-mortem examination is necessary in suspected cases of anthrax in which a microscopic examination of the blood failed to give a positive diagnosis.

Dehorning (*Agr. Jour. Cape Good Hope, 17 (1900), No. 7, pp. 387–390*).—A brief account of this operation, taken in part from the *Sydney Telegraph*.

Three important diseases affecting sheep, J. D. STEWART (*Agr. Gaz. New South Wales, 11 (1900), No. 10, pp. 837–846*).—Notes on stomach worms, lung worms, fluke worms, and foot rot. The author recommends the most approved remedies for the treatment of each of these diseases.

Etiology of louping ill, J. MCFADYEAN (*Jour. Comp. Path. and Ther., 13 (1900), No. 2, pp. 145–154*).—The author gives a general historical account of this disease. The name louping ill has apparently been applied to a number of distinct diseases, such as pyæmic spinal meningitis, gastritis, enteritis, and disorders of brain functions. The relationship of grass ticks to louping ill is believed by the author to be a problematical question. The author concludes that the etiology and pathology of the disease are still obscure and that the whole subject needs a careful investigation.

Periodical ophthalmia of the horse, L. BERNHARD (*Berlin. Tierarztl. Wchnschr., 1900, No. 26, pp. 301–304*).—Detailed notes on the symptoms of the disease, together with an account of its prevalence.

Malignant œdema in horses, S. v. RATZ (*Monatsh. Prakt. Thierh., 11 (1900), No. 9, pp. 411–416*).—Detailed reports are given on the clinical symptoms and post-mortem findings of 2 cases of this disease in horses. The bacilli were strikingly similar to those of blackleg. White mice inoculated with œdematous material died 2 days later.

The pathogenic organism of horse sickness, RICKMANN (*Berlin. Tierarztl. Wchnschr., 1900, No. 27, pp. 314–316, fig. 1*).—It was found by experiment that if virulent blood from a case of this disease was passed through a Chamberlain filter it ceased to be virulent. A microscopic examination of such blood revealed the presence of micro-organisms similar to those of malaria.

The horses of South Africa and their most important diseases, especially malaria, ZÜRN (*Ztschr. Tiermed., 4 (1900), No. 2–3, pp. 143–163*).—The author gives a description of the tsetse fly (*Glossina morsitans*) and discusses its agency in the transmission of malaria to horses. A number of species of flies of the same genus

are found in South Africa and many of them have been suspected of carrying malaria. The author offers a critical review of the literature of this subject. Notes are also given on anthrax and strangles. Detailed directions are given for the application of the most important methods for destroying mosquitoes and the tsetse fly and for keeping these insects out of stalls and stables.

Chronic tuberculosis in the horse, M. SCHWAMMEL (*Ztschr. Tiermed., 4 (1900), No. 2-3, pp. 182-186*).—The author reviews briefly the literature on tuberculosis in the horse. Detailed notes are given on a post-mortem examination of a case of chronic tuberculosis in the horse. In general the post-mortem appearances were similar to those of bovine tuberculosis. The disease was readily distinguishable from glanders by the fact that the characteristic lesions of glanders were absent. The horse had been kept on an estate where from 60 to 80 per cent of cattle were infected with tuberculosis. Some of the cattle were draft oxen and had been allowed to stand temporarily in the same stall where the horse was kept. It is believed that the disease was transmitted in this manner.

The hyphomycetous nature of the glanders bacillus, H. CONRADI (*Ztschr. Hyg. u. Infectionskrank., 33 (1900), No. 2, pp. 161-177, pls. 2*).—The author gives a review of the literature on the subject of the morphological structure of the glanders bacillus. From a bacteriological study of the organism of glanders, the author believes that it does not belong properly to the bacteria, since it was shown that the normal developmental processes of the organism lead to stages which show a monopodial branching and false branching similar to that of Cladothrix. The organism of glanders is believed by the author to be closely related to the Actinomyces group fungi.

Pathological-anatomical studies of the Borna disease, H. DEXLER (*Ztschr. Tiermed., 4 (1900), No. 2-3, pp. 110-121, figs. 3*).—An examination of the cervical region of the spinal cord in cases of this disease disclosed the presence of a recent inflammation of the membranes which had progressed for some distance into the substance of the brain and spinal cord. From a careful study of cases of the Borna disease, the author considers as diagnostic certain structural changes in the central nervous system, especially in the substance of the cervical region of the spinal cord, the piamater of the hemispheres, the lateral plexus of the cerebellum and in the cortex of the cerebrum. The author concludes that the Borna disease should be characterized as a meningo-encephalitis and myelitis.

The etiology of rabies, S. v. RATZ (*Monatsh. Prakt. Thierh., 11 (1900), No. 9, pp. 402-410*).—The author gives a critical review of the literature relating to the possible hereditary transmission of rabies. From the brain of a pregnant cow which had died of rabies, material was taken for the inoculation of rabies with the result that the characteristic symptoms of rabies were produced in the experimental animals. Material taken from the fœtal brain failed to produce rabies in rabbits. The author made a number of experiments in inoculating animals with material from the brain of dogs which had died of rabies. The dogs were allowed to remain buried for varying periods before the material was taken from the brain for inoculation. The results of these experiments indicate that the virus of rabies is present in the brain of dogs which have been buried from 14 to 24 days. Putrefaction, however, had the effect of weakening the virulence.

Experiments on the action of Epicarin in the treatment of mange of dogs, REGENBOGEN (*Monatsh. Prakt. Thierh., 11 (1900), No. 4, pp. 145-149*).—Experiments made by the author for the purpose of determining the value of epicarin in the treatment of dog mange gave the following results: Epicarin given internally in 0.5 gm. per kilogram of body weight is not poisonous. Isolated *Sarcoptes squamiferus* and *Acarus folliculorum* were killed much less quickly by alcoholic solutions of epicarin than by solutions of cresol preparations. The treatment of mangy dogs was not satisfactory, since considerable time and trouble were involved in the application of the method and the results were uncertain.

TECHNOLOGY.

Preservation of unfermented grape must, F. T. BIOLETTI and A. M. DAL PIAZ (*California Sta. Bul. 130, pp. 12, figs. 4*).—The composition of pure grape must and of the products sometimes found on the market is discussed, as well as the causes of spoiling of grape juice and the chemical and physical means of preventing fermentation. Chemical methods, *i. e.*, the use of germ poisons or antiseptics, are condemned. The physical methods, especially those depending upon the application of a temperature sufficiently high to kill all germs, are considered safest and most reliable. Such a method is described in some detail. It is recommended that only clean and perfectly sound grapes, picked and handled when cool, should be used. After the juice is expressed it is allowed to settle 24 hours and then run through a continuous pasteurizer in which it is heated to 80° C. (176° F.), but comes out not warmer than 25° C. (77° F.). It is again allowed to settle in closed sterilized casks and filtered. For this purpose a filter so constructed that the must passes upward through the filtering medium under pressure is recommended. The filtered juice is placed in bottles previously sterilized, and the stoppered bottles are kept in a water bath heated to 85° C. (185° F.) for 15 minutes (for quart champagne bottles). By this means the contents of the bottles are heated to about 75° C. (167° F.). If a higher temperature is used for the second sterilization than for the first the must becomes cloudy. To prevent the growth of mold on the corks in storage they may be dipped in hot paraffin or 2 per cent bluestone solution.

Utilization of pure yeasts in wine fermentation, R. CHODAT (*Arch. Sci. Phys. et Nat., 8 (1899), pp. 588, 589; abs. in Jour. Roy. Micros. Soc. [London], 1900, No. 2, pp. 237, 238*).—The advantages of the use of pure yeasts in wine fermentation are pointed out and details of an investigation of a red wine of Crete are given. Six species of Saccharomyces were isolated from this wine, one of which belonged to the *S. apiculatus* group, the rest being true yeasts. The amount of alcohol produced by these different yeasts in sterile must is given, and the quantity of glucose destroyed in the production of alcohol or in their own maintenance varied from 7 to 84.4 per cent of the amount present.

Keeping cider, SCHELLENBERG (*Jahresber. Vers. Stat. u. Schule, Wädensweil, 1897–98, pp. 33–36*).—Three casks, each containing 600 liters, were filled with pear cider of like quality. After fermentation the cider was left with the dregs in one case, drained off in the second, and filtered through a cellulose filter in the third, after which the cider in all 3 casks was left in a storage cellar. The summer following the cider in the first cask tasted of the dregs and was of poor quality; that in the second was clear and tasted pure. The cider in the third cask was the best in quality of all. It was not only clear and pure tasting, but had also a fresh, lively character. The conclu-

sion is reached that both the keeping quality and character of pear cider is improved by filtration after fermentation.

In another experiment pears, still hard, but which fell easily from the trees, yielded 58 liters of juice per 100 kg. of fruit. Good, ripe, mellow fruit yielded 65 liters per 100 kg. of fruit; while overripe fruit yielded but 57.2 liters per 100 kg. of fruit.

The keeping quality but not the taste of pear cider was improved by the addition of sugar and water to the juice before fermentation.

Wine making in hot climates, L. Roos, translated by R. Dubois and W. P. Wilkinson (*Melbourne: Government, 1900, pp. 273, pls. 4, figs. 59*).—This is one of the publications of the Viticultural Station of the Department of Agriculture of Victoria, Australia, located at Rutherglen.

The use of yeast in making currant wine, W. Kelhofer (*Jahresber. Vers. Stat. u. Schule, Wädensweil, 1897–98, pp. 53–57*).—Pure yeast cultures, beer yeast, dry pressed yeast, and no artificial addition of yeast whatever, were used in making currant wine. The chemical composition of the wine produced in each case is tabulated. The conclusion is reached that when pure yeast for wine-making can not be obtained, a good wine for household purposes can be made by the use of fresh beer yeast at the rate of 50 cc. per hectoliter of juice. Next in value would be newly-made dry yeast, using 20 gm. for each hectoliter of juice. The fermentation of berries and juice together resulted in bad-tasting wine which easily spoiled.

Wine making in Russia, M. Ballos (*St. Petersburg: Department of Agriculture, 1899, pt. 5, pp. XV+455; rev. in Selsk. Khoz. i Lyesov., 196 (1900), Feb., p. 469*).—This volume is devoted to a description of the industry in Southern Russia.

The briar root industry in Italy (*Sci. Amer. Sup., 50 (1900), No. 1292, p. 20718*).—A record of the production of the root of *Erica arborea* for use in making tobacco pipes.

AGRICULTURAL ENGINEERING.

Water resources of Porto Rico, H. M. Wilson (*Water Supply and Irrigation Papers, U. S. Geol. Survey, No. 32, pp. 48, pls. 15, maps 2, figs. 10*).—This is a report based on notes, sketches, and photographs collected by the author "during a brief journey made through the Island of Porto Rico in January, 1899. The object of this trip was primarily to study the topographic characteristics and the water resources of the island, but incidentally numerous memoranda relative to the soil, agricultural products, and forests were obtained."

The following topics are discussed: Topographic relief—coastal topography, and physiography and scenery; climatology—precipitation and temperature; hydrography—irrigation; agricultural lands and soil—old fields and fertilizers, and agricultural products; forestry; water power and supply; and transportation facilities.

On about three-fourths of the area of the island (north side) the rainfall is sufficient for crops.

"The other one-fourth, including all the region near the coast and from Cabo Rojo on the extreme west to beyond Guayama on the east, must be irrigated if the soil is to produce the full measure of crops of which it is capable. The total area of these irrigable lands is, however, relatively small. . . .

"The soil on these lands is in every case of the very best kind for agriculture with irrigation. It is usually an open, porous, limestone soil of sandy and gravelly texture, mixed with a little earthy loam. It is fairly deep and is underlain by a porous limestone or coral, which affords the best drainage and probably renders it safe from the danger of producing alkali. . . .

"While the precipitation is insufficient, the perennial flow of the streams is unusually abundant for a land requiring irrigation. The minimum discharges of these streams where they would be diverted in the foothills are moderate in amount and yet nearly sufficient for the irrigation of such areas as they command. Moreover, the flood discharges of these streams occur at frequent intervals throughout the year, but are especially well distributed throughout the summer or rainy season. They afford an abundant surplus for storage. The shapes of the smaller parting valleys and of the lower canyons through which the rivers emerge from the mountains give every indication that abundant opportunities will be found, on fuller investigation, for the construction of storage reservoirs at moderate expense and at relatively small cost."

Irrigation has been practiced to some extent, especially on sugar cane. The irrigation works which have been constructed correspond in general type with those of Mexico, but are usually of a more substantial character. Temporary distributaries, however, are used to a considerable extent in the irrigation of sugar cane.

"The volume of water available for utilization either as supply for domestic purposes in the various cities or for conversion into power through the agency of water wheels is relatively great. While this is especially true of the north side of the island, it applies also in a measurable degree to the south side."

The soils of the island are primarily of two classes—calcareous and clay. In some localities they have been over cultivated without fertilization and are now abandoned, but as a rule "the soil of Porto Rico is so deep and fertile, the precipitation so abundant and well distributed, and the temperature, though tropic, so mild as to render it possible to cultivate almost all the land on the island."

Supplies of fertilizers—green sand marl, guano, phosphates, etc.—are abundant.

Road making and maintenance, T. AITKEN (*London: Charles Griffin & Co., 1900, pp. XVI+440, pls. 12, figs. 118, dgms. 3*).—"This treatise is divided into two parts. The first relates to the making and the maintaining of macadamized roads, while the second part deals with carriageways and footpaths." There is a preliminary historical sketch of road making and maintenance. Chapters are devoted to the following subjects: Resistance to traction—wheels and weights on them; laying out new roads, and the improvement of existing lines of communication; earthworks, drainage, retaining walls, culverts, bridges, and protection of roads; road materials or metal: quarrying; stone breaking and haulage; road rolling and scarifying; the construction of new, and the maintenance of existing roads; carriageways and footways—preliminary remarks—foundations and pitched pavements; wood pavements; asphalt pavements; brick pavements, tar macadam, and miscellaneous materials used for carriageways—conclusions; footways, curbs, channels, gullies, paving materials for footpaths; and subways. Methods of carrying out the work and the cost of each operation in the systematic making and repairing of roads and streets and the construction and maintenance of carriageways and footways are given in detail, the information being for the most part the result of practical experience extending over a number of years. The methods apply especially to English conditions.

Some preliminary notes on the hygienic value of various street pavements as determined by bacteriological analyses, S. BURRAGE and D. B. LUTEN (*Proc. Indiana Acad. Sci., 1899, pp. 61–67, figs. 7*).—Examinations of cultures exposed on an ordinary surveyor's tripod over various kinds of pavements are reported. The conclusion is reached from these observations that "if the amount of dust floating over any given pavement is a measure of the sanitary value, the pavements in question will take the following rank: Wood, brick, sheet asphalt, and macadam."

Hydrography of Nicaragua, A. P. DAVIS (*Twentieth Ann. Rpt. U. S. Geol. Survey, 1898–99, pp. 563–637, pls. 12, figs. 4*).—This paper gives the results of observations made during 1898 in connection with the investigations of the Nicaragua Canal Commission. It deals with general topographic features, rainfall, temperature and relative humidity, evaporation, resources and productions, population, the ship transit problem, and investigations by the Nicaragua Canal Commission, 1898.

Report of progress of stream measurements for the calendar year 1898, F. H. NEWELL (*Twentieth Ann. Rpt. U. S. Geol. Survey, 1898–99, pt. 4, pp. 1–562, pls. 63, figs. 218*).—This is a detailed report of measurements which have been published in previous bulletins of the Survey (E. S. R., 11, p. 1094).

Influence of vegetation on the water flow of rivers, E. WOLLNY (*Vrtljschr. Bayer. Landw. Rath., 5 (1900), No. 3, pp. 389–445*).

Mitigation of floods in the Brisbane River, A. C. GREGORY (*Queensland Geogr. Jour., n. ser., 15 (1900), No. 1, pp. 41–54*).

Bearing-testing dynamometer, M. J. GOLDEN (*Proc. Indiana Acad. Sci., 1899, pp. 83–85, fig. 1*).—A machine used by the author to determine the amount of power lost by friction in different forms of shaft bearings is described.

The stave silo, J. H. GRISDALE (*Canada Cent. Expt. Farm Bul. 35, pp. 11, figs. 8*).—Brief directions are given for the construction of a stave silo similar to that described by the New York Cornell Station (E. S. R., 11, p. 294), and of a cheap rectangular silo, with notes on crops for silage and methods of filling a silo.

A mechanical cotton picker (*Sci. Amer., 82 (1900), No. 21, p. 330, fig. 1*).—Brief technical description.

STATISTICS—MISCELLANEOUS.

Eleventh Annual Report of Delaware Station, 1899 (*Delaware Sta. Rpt. 1899, pp. 201*).—This includes a financial statement for the fiscal year ended June 30, 1899, the organization list of the station, summarized and detailed reports of the work of the different departments during the year, a number of articles abstracted elsewhere, and reprints of Bulletins 42, 44–46 of the station on the following subjects: The European and Japanese chestnuts in the eastern United States (E. S. R., 10, p. 962), sorghum in 1899 (E. S. R., 11, p. 141), the root pruning of young fruit trees (E. S. R., 11, p. 845), the southern or cowpea in Delaware (E. S. R., 12, p. 435), dairy value of pea-vine silage compared with that of June pasture (E. S. R., 12, p. 481).

Thirteenth Annual Report of New York Cornell Station, 1900 (*New York Cornell Rpt. 1900, pp. XL + 562*).—The report proper includes the organization list of the station and brief reports on the work and expenditures of the station by the director, treasurer, and heads of departments. The report of the assistant professor of dairy husbandry and animal industry gives in addition a statement of conditions governing butter tests of thoroughbred cows made by the station and directions for station representatives in conducting official tests of dairy cows. Appendix I contains reprints of Bulletins 171–182 of the station on the following subjects: Concerning patents on gravity or dilution separators (E. S. R., 11, p. 389), the cherry fruit fly—a new cherry pest (E. S. R., 11, p. 866), the relation of food to milk fat (E. S. R., 11, p. 1081), the problem of impoverished lands (E. S. R., 11, p. 1022), fourth report on Japanese plums (E. S. R., 11, p. 1045), the peach-tree borer (E. S. R., 12, p. 63), spraying notes (E. S. R., 12, p. 163), the invasion of the udder by bacteria

(E. S. R., 12, p. 184), introduction to field experiments with fertilizers (E. S. R., 12, p. 125), the prevention of peach-leaf curl (E. S. R., 12, p. 259), pollination in orchards (E. S. R., 12, p. 237), and sugar-beet investigations for 1899 (E. S. R., 12, p. 335). Appendix II contains a detailed statement of receipts and expenditures of the station for the fiscal year ended June 30, 1899. Appendix III contains reprints of publications on nature study.

Twelfth Annual Report of Rhode Island Station, 1899 (*Rhode Island Sta. Rpt. 1899, pp. IX + 227*).—The report of the director gives a general review of the work of the station during the year and departmental reports review in detail the different lines of work and contain a number of articles noted elsewhere. A financial statement for the fiscal year ended June 30, 1899; lists of donations, exchanges, and station publications; and an index to the report and Bulletins 52–55 of the station issued during the year, are included.

Experiment Station Work—XV (*U. S. Dept. Agr., Farmers' Bul. 119, pp. 31, figs. 5*).—This number contains articles on the following subjects: Storing apples without ice, cold storage on the farm, mechanical cold storage for fruit, keeping qualities of apples, improvement of blueberries, transplanting muskmelons, banana flour, fresh and canned tomatoes, purslane, mutton sheep, effect of cotton-seed meal on the quality of butter, grain feed of milch cows, and protection against Texas fever.

Timely hints for farmers (*Arizona Sta. Bul. 34, pp. 65–115, figs. 14*).—This bulletin is a collection of popular articles issued by the experiment station from October 1, 1899, to June 15, 1900. The following subjects are discussed: Green manuring plants for orchards, planting eucalypts in Arizona, improvement of Arizona soils, winter irrigation of orchards, the crown gall, desirable varieties of peaches, the danger of introducing insects on trees, what to plant on arbor day, winter remedies for injurious insects, care of milk for the factory, black alkali, white alkali, selecting dairy cows, the adobe hole, dehorning cattle, date palm culture, summer cultivation, and grazing *v.* irrigation.

Agricultural exports of the United States by countries, 1895–1899, F. H. Hitchcock (*U. S. Dept. Agr., Section of Foreign Markets Bul. 20, p. 88*).—Statistical tables are given showing the character and value of the agricultural products exported from the United States to each country of destination during the 5 fiscal years 1895 to 1899. The average annual value of the agricultural exports during the 5 years was $694,874,000. The United Kingdom received 53.37, Germany 13.60, and France 6.22 per cent of the total exports. Of the products exported cotton, breadstuffs, and meat products amounted respectively to 30.71, 30.56, and 20.36 per cent.

Agricultural imports of the United States by countries, 1895–1899, F. H. Hitchcock (*U. S. Dept. Agr., Section of Foreign Markets Bul. 21, pp. 74*).—Statistical tables are given showing the character and value of the agricultural products imported into the United States from each country of shipment during the 5 fiscal years 1895 to 1899. The average annual value of the agricultural imports during the 5 years was $366,964,708. Brazil supplied 14.75, the United Kingdom 9.30, Cuba 7.47, and Germany 6.57 per cent of the total imports. Of the products imported, sugar amounted to 22.90 per cent, and coffee, 20.86 per cent.

The production and consumption of corn in United States, Hungary, Roumania, and other countries, E. Rabate (*Jour. Agr. Prat., 1900, II, No. 46, pp. 721–725*).—Statistics and discussion.

List of free employment agencies for the use of farmers (*U. S. Dept. Agr., Division of Statistics Circ. 13, pp. 42*).—"A list of free employment agencies, and other institutions and individuals willing to act as such, which are likely to be able to supply farm laborers, domestic servants, or other employees for permanent or temporary employment in the country." The list includes nearly 1,000 names arranged by counties in the different States.

NOTES.

TENNESSEE STATION.—The executive committee of the station has been reorganized with J. W. Caldwell, of Knoxville, as chairman, and J. B. Killebrew, of Nashville, and Harris Brown, of Gallatin, as additional members. At the semiannual meeting of the board of trustees Andrew M. Soule was elected vice-director of the station, in addition to his duties as professor of agriculture and agriculturist. The vice-director will henceforth supervise the work and business of the station under the direction of the president. There are 35 students attending the dairy school, and a keen interest and appreciation of the work the station and college of agriculture are doing is evidenced on every hand. The agricultural yearbook for 1891 was recently issued, and has proved very popular among the farmers all over the South. In fact, the demand for publications has become so great that with the limited resources at the command of the station it is becoming a difficult problem to meet the call for station literature.

FIFTH INTERNATIONAL CONGRESS OF ZOOLOGY.—The preliminary announcement of the Fifth International Congress of Zoology, to be held at Berlin, August 12–16, has been received. In addition to the regular sessions of the congress and of sections, various excursions are planned to zoological museums, gardens, institutes and other institutions likely to be of interest to zoologists, a reception, and a banquet. The formal meetings of the congress will conclude Friday noon, and in the afternoon the delegates will proceed to Hamburg, visiting the national-history museum and the zoological gardens, and on Sunday (August 18) an excursion to Heligoland to visit the biological station there is planned. Anyone interested in zoology may become a member of the congress on payment of $5, which will insure a report of the congress. All correspondence relating to the congress or to the programme should be addressed to the president of the congress, 43 Invalidenstrasse, Berlin, N. 4.

AGRICULTURAL EXPERIMENTATION AND EDUCATION IN THE WEST INDIES.—At the third agricultural congress, held at Barbados, January 5, Dr. D. Morris, commissioner of agriculture for the West Indies, described the progress which is being made under the Imperial Department of Agriculture in the direction of agricultural experimentation and investigation. "During the year three new experiment stations have been establishment at Montserrat and one at Tortola for the Virgin Islands. At the present time there are 9 botanic stations maintained from imperial funds under the charge of the Imperial Department of Agriculture. In addition, there are 20 substations, or experiment plats, started at Grenada, St. Vincent, St. Lucia, and Dominica to encourage the improved cultivation of cacao, coffee, limes, and other crops. There are 12 central, manurial, and local stations associated with the sugar-cane experiments at Barbados, 7 similar stations at Antigua, and 3 at St. Kitts-Nevis. Experimental cultivation with food and other crops will be carried on in connection with all the agricultural schools." During the past year lectures to teachers in charge of elementary schools have been carried on in every part of the West Indies, and the belief is expressed that within a year or two, in the smaller islands at least, every teacher in charge of a school should be qualified, not only to give a certain amount of instruction in the principles of agriculture, but also to interest the children by simple experiments followed by practical demonstrations in the cultivation of plants suited to the district. The first agricultural school in the West Indies affording

secondary education for boys was opened at St. Vincent in September, and a similar school was opened at Dominica in December, 1900. It is planned to establish two more agricultural schools the present year, one at St. Lucia and another, combining the characters of an agricultural school and grammar school, at St. Kitts. Seven scholarships in agriculture at Harrison College, Barbados, have been established by the Imperial Department of Agriculture. Agricultural fairs have been successfully conducted, and have proved of value in stimulating effort toward better production. The Department of Agriculture has encouraged these by prizes amounting to £350 and the distribution of 100 diplomas.

Miscellaneous.—Congress has ordered a reprint of 5,000 copies of Bulletin No. 80 of this Office, the account of the agricultural experiment stations of the United States, prepared for the Paris Exposition. Of this revise the Department of Agriculture is to have 2,000 copies.

Science states that a committee has been appointed by the president of the British board of agriculture to conduct experimental investigations regarding the communicability of glanders under certain conditions, and the arresting and curative powers of mallein when repeatedly administered. The committee consists of A. C. Cope, chief veterinary officer of the board of agriculture; J. McFadyean, principal of the Royal Veterinary College; William Hunting, veterinary inspector; and J. McIntosh McCall, assistant veterinary officer of the board of agriculture.

As a result of correspondence of a committee of the Society of Plant Morphology and Physiology with the editor of the *Botanisches Centralblatt*, urging certain changes in that journal, the editor announces that hereafter the regular series of the *Centralblatt* will be confined to abstracts and reviews of new literature. The original articles will be published in the *Beihefte* or supplements issued from time to time, and the regular series of the *Beihefte* can be subscribed for separately. An American board of editors of the *Centralblatt*, to be selected by the society, is also provided for. It is thought that these changes will make the *Centralblatt* a more valuable medium through which American botanists may keep posted on the progress of their science and the new literature relating to it.

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EXPERIMENT STATION RECORD.

Editor: E. W. ALLEN, PH. D., *Assistant Director.*

EDITORIAL DEPARTMENTS.

Chemistry, Dairy Farming, and Dairying—The EDITOR and H. W. LAWSON.
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With the cooperation of the scientific divisions of the Department and the Abstract Committee of the Association of Official Agricultural Chemists.

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LIST OF PUBLICATIONS ABSTRACTED.

EXPERIMENT STATION RECORD.

VOL. XII. No. 9.

The physical and chemical processes involved in the ripening or curing of cheese are extremely complex, and exact knowledge relating to them has been sadly wanting until very recent years. As a cheese matures or becomes fit for consumption not only is there produced the characteristic flavor that is peculiar to the type of cheese made, but with all kinds, regardless of the quality of flavors formed, a profound physical transformation of the casein occurs. In this change the firm elastic curd "breaks down;" *i. e.*, becomes plastic, and, from a chemical point of view, the insoluble casein is converted into various soluble decomposition products.

In discussing these ripening phenomena, the production of flavor and the breaking down of the casein—*i. e.*, the formation of proper texture—have been regarded as different phases of the same process. But, as later shown, these changes are not necessarily so closely correlated.

The theories that have been advanced in the past as explanatory of the ripening changes in cheese have been suggestive rather than founded on experimental data, and it is only within the last five years that carefully controlled scientific studies of this problem have been made.

At the present time two theories have been advanced which purport to account for the changes involved. One of these, which is essentially European, ascribes the ripening changes wholly to the action of living organisms—the bacteria present in the cheese. The other originated in this country, and asserts that there are digestive enzyms inherent in the milk itself that render soluble the casein of the milk.

The adherents of the bacterial theory are divided into two classes. One, led by Duclaux, considers that the breaking down of the casein is due to the action of liquefying bacteria (Tyrothrix forms). On the other hand, von Freudenreich has ascribed these changes to the lactic-acid type of bacteria, which develop so luxuriantly in hard cheese.

Within the limits of this article it will be impossible to give a critical review of these theories that would do justice to the question at issue. But in view of important practical results recently obtained by Babcock and Russell, of the Wisconsin Experiment Station, it is

deemed advisable to review the theory promulgated by them and show its relation to their later work.

In 1897 they announced the discovery of an inherent enzym in milk which they termed *galactase*, and which has the power of digesting casein of milk and producing chemical decomposition products similar to those that normally occur in ripened cheese. The theory has been advanced by them that this enzym is an important factor in the ripening changes, and, as in their experiments bacterial action was excluded by the use of anæsthetic agents, they conclude that so far as the breaking down of the casein is concerned bacteria are not essential to this process.

In formulating a theory of cheese ripening, they have further pointed out the necessity of considering the action of rennet extract as a factor that is concerned in the curing changes. They have shown that the addition of increased quantities of rennet extract materially hastens the rate of ripening, and that this is due to the pepsin which is present in all commercial rennet extracts. They find it easily possible to differentiate between the proteolytic action of pepsin and galactase, in that the first-mentioned enzym is incapable of producing decomposition products lower than the peptones precipitated by tannin. They have shown that the increased solubility (ripening changes) of the casein in cheese made with rennet is attributable solely to the products peculiar to peptic digestion. The addition of rennet extract or pepsin to fresh milk does not produce this change unless the acidity of the milk is allowed to develop to a point which experience has shown to be the best adapted for the making of Cheddar cheese. The rationale of the empirical process of ripening the milk before the addition of the rennet extract is for the first time thus explained.

In studying the properties of galactase these investigators further found that this enzym, as well as those present in rennet extract, is operative at very low temperatures, even below the freezing point. These results have not yet been published, but were presented at a recent convention of the Wisconsin Cheese Makers' Association. When cheese made in the normal manner was kept at temperatures ranging from 25 to 45° F. for periods averaging from 8 to 18 months, it was found that the texture of the product simulated that of a perfectly ripened cheese, but that such cheese developed a very mild flavor in comparison with the normally cured product. Subsequent storage at somewhat higher temperatures gives to such cheese a flavor the intensity of which is determined by the period of storage. This indicates that the breaking down of the casein and the production of the flavor peculiar to cheese are in a way independent of each other and may be independently controlled, a point which is of great economic value in commercial practice.

Although it is generally believed that cheese ripened at low temperatures is apt to develop a more or less bitter flavor, the flavors in these

cases were found to be practically perfect. Under these conditions of curing bacterial activity is practically inoperative, and these experiments furnish an independent proof of the enzym theory.

Not only are these experiments of interest from the scientific point of view, as throwing light on the obscure processes of cheese curing, but from a purely practical standpoint they open up a new field for commercial exploitation.

The inability to control the temperature in the ordinary factory curing room results in serious losses on account of the poor and uneven quality of the product, and the consumption of this dairy product has been greatly lessened thereby. All of these conditions may be avoided by this low-temperature curing process, and it seems quite probable that the cheese industry is on the eve of important changes in methods of treatment.

With the introduction of cold-storage curing, and the necessity of constructing centralized plants for this purpose, the cheese industry will be differentiated into the manufacture of the product in factories of relatively cheap construction, and the curing or ripening of the cheese in central curing stations. In this way not only are the losses which occur in present practice obviated, but the improvement in quality of the cured product will be more than sufficient to cover the cost of cold-storage curing. It is important to note that this latest advance in methods as applied to commercial practice is the outgrowth of scientific studies on the theoretical side of the subject of cheese ripening, and well illustrates how dependent practice is on the pursuit of pure science.

The passage of the agricultural appropriation act for the year 1901–1902 marks an epoch in the history of the development of the national Department of Agriculture. Not only does it carry the largest appropriation ever made for the Department and provide for further extension of its work in various lines, but it inaugurates a scheme for the partial reorganization of the scientific branches of its work. Three of the present divisions are raised to the grade of bureaus, and a number of other divisions are associated into one large Bureau of Plant Industry, corresponding in a general way to the present Bureau of Animal Industry.

Starting first as an appendix to the Patent Office for the distribution of seeds, the Department of Agriculture was formally organized in 1862 as an independent department in charge of a commissioner, and in 1889 was raised to the dignity of an Executive Department. The passage of the Hatch Act providing for agricultural experiment stations about that time increased its responsibilities and extended its field of usefulness.

The growth of the Department has been steady and uninterrupted. The importance of its work has been recognized by steadily increasing

appropriations, and the relations maintained with the experiment stations furnish a means of carrying its investigations into every section of the country, in cooperation with these institutions, and serve to broaden its influence. As an institution for agricultural investigation it is now without a counterpart in any country, and there are few, if any, scientific institutions which include so large an aggregation of scientists and experts devoting their attention to investigation and research. The Department is coming to be generally recognized as one of the great scientific institutions, not alone in this country, but of the whole world. The formation of bureaus is a fitting step at this juncture, for it is a recognition of the growth which has been made and the need for a more compact form of organization. The creation of these four new bureaus, in addition to the Weather Bureau and the Bureau of Animal Industry, is a following out of the general divisions into which the subject of agriculture seems logically to fall, associating such lines of work as relate closely to each other and providing for the closest cooperation practicable among them.

The new Bureau of Plant Industry embraces the divisions of Botany, Vegetable Physiology and Pathology, Agrostology, Pomology, and Gardens and Grounds, and is under the directorship of B. T. Galloway. To this bureau has also been assigned the Section of Seed and Plant Introduction, together with the general supervision of the experiments in tea culture. A horticulturist will be added to the list of specialists, with the intention of developing the work of investigation along that line. From the standpoint of administration the arrangement will be an economy of time and will give greater opportunities for investigation to the chiefs of the divisions.

In recognition of the plan for a systematic survey of agricultural soils and for extension of the work in forestry, the divisions of Soils and Forestry are given bureau organizations and are raised to that designation. The fourth bureau provided for is the Bureau of Chemistry, to which additional scope will be given.

The appropriation act makes frequent mention of cooperation between the different divisions of the Department and also with the agricultural experiment stations. The establishment of the Bureau of Plant Industry will favor the extension of this cooperation and will assist in adjusting the lines of work and preventing any tendency to duplication.

Of the new bureaus the Bureau of Plant Industry receives the largest appropriation, namely, $231,680. The amounts appropriated for the different lines of investigation in charge of this bureau, aside from certain salaries, are $60,000 for investigations in vegetable pathology and physiology, $20,000 for pomological investigations, $45,000 for botanical investigations and experiments, $20,000 for grass and forage plant investigations, $20,000 for seed and plant introduction, $7,000 for tea-culture experiments (an increase of $2,000), and $20,000 for

gardens and grounds. The total appropriation for the Bureau of Plant Industry represents an increase of $61,900 over the combined appropriations for the previous year of the divisions associated in it. A new feature of the botanical investigations is the study of useful plants of the tropical territory of the United States, together with plants likely to be of value for introduction into those sections. Furthermore, investigations are to be made on "the varieties of wheat and other cereals grown in the United States and suitable for introduction, in order to standardize the naming of varieties as a basis for experimental work of the State experiment stations and as an assistance in commercial grading;" and in cooperation with the Bureau of Chemistry the cause of deterioration of export grain, particularly in oceanic transit, is to be investigated, together with means of preventing such loss. Special mention is made in the appropriations for this bureau of the employment of scientific aids, a class of employees drawn from the Agricultural Colleges, which has previously been arranged for in the Department.

The Bureau of Forestry receives $185,440, an increase of $105,440 over the previous year. The appropriation for the Bureau of Soils is $109,140, which is an increase of $77,840. This is to enable an extension of the tobacco investigations, which remain in charge of this bureau, and the investigation and mapping of soils in the United States. The Bureau of Chemistry receives $35,800, and in addition to its other duties is charged with the investigation of food preservatives and coloring matters "to determine their relation to digestion and to health and to establish the principles which should guide their use."

The Weather Bureau receives increased appropriation for general maintenance, and $46,000 for the erection and equipment of buildings in six different places, and for laying a cable between the mainland and Tatoosh Island, Washington, making the total appropriation $1,148,320. The maintenance fund of the Bureau of Animal Industry is increased $50,000, and the inspection work is extended to include dairy products intended for exportation to foreign countries. Such products, the same as meats, may be marked, stamped, or labeled, so as to secure their identity and indicate their purity, quality, and grade. This is an entirely new provision, which it is hoped will tend to place American dairy products on a better footing in foreign markets. An appropriation of $25,000 is made, in addition to one of $50,000 last year, for animal quarantine stations, giving a total for the bureau of $1,154,030.

The appropriations for agricultural experiment stations has reached the sum of $789,000, including $33,000 for the Office of Experiment Stations, as heretofore, and $12,000 each for stations in Alaska, Hawaii, and Porto Rico. The Hawaii station will be located near Honolulu on a Government reservation originally set apart by the provisional government for the use of an experiment station. It is intended to make the work there supplementary to that of the experi-

ment station which has been maintained by the Hawaiian sugar planters, and attention will be given to other field crops and the development of animal industry and horticulture. Jared G. Smith, recently in charge of the Section of Seed and Plant Introduction of this Department, has been placed in charge of the Hawaii station, and will take up the work there about the middle of April. Fifty thousand dollars was appropriated to continue the irrigation investigations, and $20,000 for nutrition investigations, the latter being an increase of $2,500.

The Division of Statistics receives $156,160, the same as last year, the Division of Entomology $36,200, and the Division of Biological Survey $32,800. The fund for publications is increased by $50,000 for farmers' bulletins and a small amount for distribution, making the total for the Division of Publications $198,020 aside from the general printing fund, $110,000. Other appropriations are as follows: Seeds $250,000, exclusive of the $20,000 mentioned for seed and plant introduction, an increase of $100,000; library, $16,000; public-road inquiries, $20,000, an increase of $6,000; investigating the production of domestic sugar, $5,000; Arlington farm, $10,000; office of the Secretary, $71,670; Division of Accounts, $18,900; Museum, $2,260, and contingent expenses, $37,000. The grand total, including the regular appropriations for the experiment stations, is $4,582,420, an increase of $558,920 over last year.

An important item of the appropriation act is the authorization of the Secretary of Agriculture to submit plans and recommendations for a fireproof agricultural building, to be erected on the grounds of the Department, and appropriating $5,000 for the preparation of such plans. The Department long since outgrew its original accommodations, and for years has been badly cramped for room. The present main building has been condemned as unsafe, and from the nature of its construction the risk of fire has always to be met. Besides erecting a number of small buildings, which are mere temporary makeshifts, it has been necessary to rent several residences in the neighborhood and adapt them to laboratory and office purposes. Laboratory buildings for the Division of Chemistry and the Bureau of Animal Industry have been specially erected by private parties and rented to the Department. The amount now paid for rental for these buildings, together with the additional expense required for watchmen, aggregates about $10,000 annually. The position to which the Department has now attained, the demands of its work, and the safety of its library, records, and collections, make a modern agricultural building a practical necessity if not an imperative need.

RUSSIAN SOIL INVESTIGATIONS.[1]

In the previous article the system of soil classification adopted by Dokouchayev and his collaborators was explained. This classification was in brief as follows: (1) Zonal soils, including lateritic soils, eolian or loess soils, soils of the dry steppes, chernozem, gray forest soils, sod and podzol soils, and tundra soils; (2) intrazonal soils, including alkali, humus-calcareous and marsh or swamp soils; (3) incomplete or azonal soils, including crude and skeleton soils, and alluvial soils. The following article discusses the characteristics of these various types of soils as they occur in Russia.

BRIEF SURVEY OF THE CHIEF SOIL TYPES OF RUSSIA.

ZONAL SOILS.

Russia, being a country of temperate and cold climates, has no lateritic soils.

Loess soils.—Loess or eolian soils occur in the hot, windy, dry climates of Turkestan and the trans-Caspian region, alternating with sandy and alkali soils. The loess soils are yellowish, bright orange, or straw colored. The percentage of humus does not exceed 2.5, and is usually less than 1. About one-half of the soil particles are less than 0.01 mm. in diameter. The other half is usually a mixture in which particles ranging in diameter from 0.01 to 0.05 mm. predominate. In a grayish loess soil from the vicinity of Tashkend there was found fine sand 65 per cent, ferric oxid 3.6, alumina 10, calcium carbonate 7 to 15, potash 2.8, and phosphoric acid 0.28 per cent. The amount of zeolites present ranged from 15 to 20 per cent and more. Loess or eolian dust soils are widely distributed, *e. g.*, not only in the Aral-Caspian basin, but in China, northwestern India, Arabia, Africa, and the drier portions of North America.

Soils of the dry steppes.—In European and Asiatic Russia, between the loess and chernozem, are found the brown and chestnut soils of the dry steppes. The area occupied by these soils in European Russia includes the vast regions between the Ural River and the lower Volga (with the exception of the sandy soils) and between the lower Volga and the district of Manitch, extending also into the steppes of Crimea

[1] Concluded from p. 712.

and over the coast of the Black Sea. In Asiatic Russia these soils cover parts of Uralsk, Turgai, Akmollinsk, and Semipalatinsk. The annual rainfall of this soil zone varies from 30 to 40 cm., one-third of which occurs during the three summer months. The natural vegetation consists mainly of drought-resisting grasses and other plants which dry up early in the season and are driven about over the steppes by the winds. The predominating parent rocks of these soils are brownish, greenish gray, and reddish Post-Tertiary clays, compact, frequently marly, and containing gypsum and soluble salts in some instances. In other cases they are loess-like or sandy. Rock fragments, pebbles, etc., are also found in the soils. The conditions in this soil zone are not favorable to rapid weathering. Light brown or brown-gray soils, poorer in humus, occupy the southern or more strictly desert portion of the belt. The chestnut soils, richer in humus, and merging into the chernozem, are found in the northern portion. The upper horizon of the first class of steppe soils is not more than 1 ft. in depth and gradually merges into the subsoil. The humus content is variable, but averages about 2 per cent. The humus is very slightly soluble in water except when alkaline salts are present. The richness of the humus in nitrogen is a characteristic feature of these soils. In a sample of steppe soil which contained only 1 per cent of humus there was found 0.12 per cent of nitrogen, equivalent to 12 per cent of nitrogen in humus. A similar observation has been made by Hilgard regarding the nitrogen content of the humus in soils of the arid region of America (E. S. R., 6, p. 197). The amount of zeolites found varied from 8 to 12 per cent. The amount of matter soluble in cold 1 per cent hydrochloric acid, excluding the carbonates, was $1\frac{1}{2}$ to 2 per cent. The upper horizon of the chestnut soils is from 1 to $1\frac{1}{2}$ ft. deep. These soils contain on the average from 3 to 4 per cent of humus, the amount sometimes being as high as 5 per cent. From 2 to 3 per cent of the soil is soluble in cold 1 per cent hydrochloric acid. A bulk analysis of subsoil from this zone showed silica 68.2 per cent, alumina 11.56 per cent, iron oxid 3.56 per cent, lime 4.63 per cent, magnesia 1.92 per cent, potash 1.98 per cent, soda 1.36 per cent, carbon dioxid 3.74 per cent, and phosphoric acid 0.15 per cent. Similar soils are found in California, Colorado, New Mexico, and other parts of the arid region of the United States.

Chernozem.—The southern third of European Russia is preeminently a region of chernozem. The area occupied by it reaches approximately 216,000,000 to 270,000,000 acres. The chernozem zone extends from the southwestern boundaries of Russia, over the basins of the Dnieper, Don, and part of the Volga, to the southern half of the Ural Mountains. It also extends beyond the Ural River and into Asiatic Russia, although it does not form a continuous belt over the mountainous region of eastern Siberia. All of the chernozem soils of Russia are found between 44 and 57° north latitude.

The chernozem territory is an undulating plain with occasionally extensive elevations and furrowed by ravines and river valleys. There is no doubt that in prehistoric times it was flatter and more uniform than at present. The climate is preeminently continental, but with less pronounced characteristics than in the zone of the dry steppes. The annual rainfall fluctuates between 40 and 50 cm., 30 cm. occurring during the period of plant growth. Agriculture suffers occasionally from droughts and from high winds which are sometimes intensely cold and at other seasons hot and dry. It is believed that at an early period of the history of the steppes, when their surface was more uniform and retained the cover of dead vegetation, the moisture conditions of the soil during winter were better than they are at present, although it is not likely that there was ever an excess of water. The chernozem zone of southern Russia has never been an uninterrupted swamp, as has been maintained by some scientists who believe the chernozem to be derived from the decomposition of peat. It was a prairie with a luxuriant growth of grass. Its natural plant cover consisted mainly of thick tall grasses interspersed here and there with bushes and shrubs. There were originally no forests except on the sandy strips and in the river valleys. The investigations of Ruprecht, Middendorf, Krasnov, Tanfilyev, Korzhinski, and other geobotanists have explained the complex character of the vegetation of these steppes meadows.[1]

Chernozem is as a rule formed by the admixture of humus with loess, but it is also sometimes derived from other parent rocks. In general, it may be stated that calcareous formations which yield fine particles on weathering are more favorable than other rocks to the formation of chernozem. In addition to this, there must be a particular combination of topography, vegetation, climatic conditions, etc., favorable to the accumulation of humus in the soil. Chernozem is usually black, the shade varying in intensity and passing sometimes into chocolate and cinnamon. Its average depth is about a meter, but this varies, the sandy chernozems being generally deeper than the clayey. The structure of the uncultivated soil is granular, the aggregates being from 2 to 4 mm. in diameter. As the soil merges into the subsoil this structure disappears and the soil becomes more compact and irregular in color, gradually assuming a brown color as it merges into the parent

[1] The list of plants growing on these steppes includes *Adonis vernalis*, *A. wolgensis*, *Pæonia tenuifolia*, *Lavatera thuringiaca*, *Linum perenne*, *L. flavum*, *Medicago falcata*, *Aster amellus*, *Trifolium* spp., *Oxytropis pilosa*, *Onobrychis sativa*, *Vicia tenuifolia* (and others), *Centaurea marschalliana*, *C. rathenica*, *Scorzonera purpurea*, *Hieracium virosum*, *Campanula sibirica*, *Echium rubrum*, *Lychnis chalcedonica*, *Thymus marschallianus*, *Salvia pratensis*, *S. nutans* (and others), *Nepeta nuda*, *Phlomis tuberosa*, *Ajuga genevensis*, *Euphorbia procera*, *Asparagus officinalis*, *Poa pratensis*, *Festuca ovina*, *Stipa pennata*, *S. capillata*, and others.

rock. The percentage of humus is quite variable, but in general declines quite uniformly from the center toward each edge of the chernozem zone. This variation is so uniform that it has been utilized by Dokouchayev in the establishment of so-called isohumic bands.

On the basis of humus content the chernozem may be divided into four genetic subtypes: (1) The humus or rich chernozem of the eastern central belt, which contains more than 10 per cent of humus; (2) the medium or ordinary chernozem, which occupies the larger part of this soil zone and contains 6 to 10 per cent of humus; (3) the southern chocolate-colored chernozem, which merges into the chestnut soils of the dry steppes, containing 4 to 6 per cent of humus; and (4) the northern cinnamon-colored chernozem of central Russia, which occurs in strips and spots, alternating with forest and light loess soils, and which contains 3 to 6 per cent of humus.

The chernozems also show wide variations in the composition of their mineral constituents, being clayey, sandy, calcareous, peaty, alkaline, etc., according to the sources from which they are derived or the conditions of their formation. The humus is but slightly soluble in water. The total nitrogen content varies from 0.2 to 0.7 per cent in the soil or from 5 to 8 per cent in humus. The clay content varies from 20 to 40 per cent, zeolites from 15 to 35 per cent. Cold 1 per cent hydrochloric acid dissolves from 3 to 5 per cent of matter from the soil, excluding carbonates. The absorptive power varies from 20 to 43 per cent. The silicates of chernozem have undergone a high degree of weathering and decomposition. Thus, of the 2 to 2.4 per cent of potash, from one-fifth to one-half dissolves in 10 per cent hydrochloric acid. Of the 8 to 10 per cent of alumina from one-half to four-fifths dissolves in the same reagent. The phosphoric acid varies from 0.12 to 0.3 per cent. In the upper horizon of the soil the carbonates, mainly calcium carbonate, do not usually exceed 1 to 3 per cent, but in chernozems derived from limestones the carbonates sometimes reach 10 to 15 per cent. The sandy portion of the chernozem is very fine, consisting of quartz, with an admixture of mica, feldspar, and other silicates. According to Kostichev, the mineral portion of chernozem, excluding the carbonates, is very similar in composition to the loess from which it is derived, there being a slight increase of phosphoric acid, due to the accumulation of humus. In the foothills of the southern Ural Mountains there occurs a variety of chernozem which contains as much as 2 per cent of phosphoric acid.

It may be said in general that the chemical properties of chernozem are more favorable than the physical. The particles are as a rule too fine, from 60 to 80 per cent of the particles being ordinarily less than 0.05 mm. in diameter, and the proportion of silt (particles less than 0.01 mm. in diameter) sometimes reaches 58 per cent. Particles larger than 0.5 mm. in diameter are either entirely absent or present in very

small quantities. As long as the chernozem preserves its natural granular structure the high percentage of fine particles has comparatively little influence upon its relation to water, but in cultivation under the climatic conditions prevailing in the steppes of southern Russia these soils to a large extent lose this structure and consequently present the properties of fine porosity, high capacity for absorbing and retaining water, and low permeability. With irregular rainfall followed by droughts the moisture of the surface soil has been observed to decrease to 6 per cent (one-seventh of its water capacity), and the soil dries and hardens, resulting occasionally in serious failures of crops.

The chernozem of Siberia has not been very fully studied. Analysis shows that it contains from 5 to 11 per cent of humus and from 0.28 to 0.6 per cent of nitrogen. In the clayey types there is from 15 to 25 per cent of zeolites, 7 to 10.5 per cent of alumina soluble in sulphuric acid, and 0.16 to 0.28 per cent of phosphoric acid. The soils of the Amur prairies are generally richer in humus than the ordinary chernozems of Russia. Soils of the chernozem type are found alternating with alkali lands and sandy soils in Banat and in the plains of eastern Hungary, which are separated by the Carpathian Mountains from the steppes of southern Russia.

The chernozem zone also embraces a considerable part of the United States. The soils of the humid prairies in Wisconsin, Minnesota, Iowa, Missouri, and other States are quite similar in character to the chernozems of the Amur region. In States such as the Dakotas, Montana, Nebraska, Kansas, and Arkansas, where the rainfall is deficient, the soils are similar to the ordinary and the chocolate colored chernozems of the steppes of southern Russia. In the more strictly arid States, such as Arizona, southern California, etc., are found analogues of the chestnut and light brown soils of Russia.

It is of interest to note that there is a southern chernozem zone represented by the soils of the pampas of Argentina. Especially fine examples of this type of soil are found in the Province of Entrerios.

Gray forest soils.—Under this name are included the soils of the wooded steppes, adjoining the chernozem or even penetrating far into the region of chernozem, but which have been modified by forest vegetation. They merge by a gradual transition into chernozem on the one hand and peaty soils or podzols on the other. They extend in a narrow, rather regular, not always continuous belt across central Russia from the governments of Lublin and Volinsk on the west to the basin of Kama and Viatka on the east. In the chernozem zone they are found usually along the rivers and valleys, where the soils are well drained and free from alkali. The observations of soil experts and geobotanists show concordantly that fine grained soils, which possess a great capacity for humidity and a low degree of permeability, and those

which contain a large amount of soluble salts are unfavorable to forest growth, particularly if the soils receive a limited supply of moisture; but that as soon as these conditions are corrected and the forest vegetation has gained a foothold in the steppe on the slope of some ravine, it is at once in condition to protect itself against the unfavorable climatic and soil influences. It gathers the snow, moderates the winds, lowers the range of the temperature, prepares for itself the soil necessary for its growth, and advances little by little into the neighboring steppe. The different stages in this process of transformation of chernozem may be observed in progress under natural conditions and may be duplicated under artificial conditions. Prof. Kostichev filled a cylindrical vessel with chernozem, covered it with a layer of leaves, and maintained it in a moist condition. In three years the chernozem was transformed into a gray soil with 2½ per cent of humus.

The upper horizon of these soils in virgin condition is 1½ to 3 dcm. in depth, gray, gray-cinnamon, or dark gray in color and almost structureless. The lower horizon, 3 to 4 dcm. and more in depth, is ash-gray, sometimes friable, but more frequently of a crumby structure. It consists of brown-gray rounded or polyhedral aggregates mixed with fine quartz and siliceous flour. An admixture of humus gives to this powder an ash-gray color. Lower down the aggregates become larger, the amount of the ash-gray powder decreases, and the horizon, gradually assuming a brown color, merges into the subsoil.

The parent rocks (subsoils) of the forest lands are usually weathered morainic clays, diluvial clays (sometimes loess-like), leached loess, and ancient sedimentary rocks—clays, marls, etc.—also weathered and leached.

The content of humus fluctuates in the upper horizon between 3 and 6 per cent; in the lower horizon it rapidly falls to 2 and even 1 per cent. The solubility of the humus in water is greater than in the case of the chernozem. The total amount of nitrogen varies from 0.01 to 0.16 per cent (4 to 5 per cent of the humus). The amount of zeolites does not exceed 20 per cent, frequently falling as low as 16 or 12 per cent. The total amount of mineral substances decomposed by 1 per cent cold hydrochloric acid is ordinarily about one-half that found in chernozem. The potash varies from 1 to 2.4 per cent, lime from 0.4 to 1 per cent, and phosphoric acid from 0.1 to 0.14 per cent. As high as 0.28 per cent of calcium carbonate has been observed. The soils are much less soluble in 10 per cent hydrochloric acid than chernozem.

The ash-colored powder of the lower horizon is considered to be a product of the action of humus acids upon the silicates, causing the separation of a part of the silica in pulverulent form.

The mechanical composition of these soils is variable. In the forest subclays of the Nijni Novgorod, Orlov, or Poltava governments the amount of particles less than 0.01 mm. (20 to 25–32 per cent) was to that of the larger ones (80 to 75–68 per cent) as 1:4, 1:3, 1:2. The

general absence of structure of the upper horizon contributes to its pulverization in plowing, resulting in an increased capacity for humidity and decreased permeability.

The subclays of the wooded steppes occupy in all respects an intermediate position between the chernozem and the "forests" subclays proper, approaching first one then the other in character. By a study of the distribution of the forest subclays and the subclays of the wooded steppes in the territory of the chernozems Dokouchayev was able to determine the areas which have been in the past occupied by forests, but which are now under cultivation. Tanfilyev has lately prepared a map of the prehistoric steppes of European Russia. Wooded steppes and true forest soils extend into Siberia. Soils identical with or very closely resembling them are also found on the plains of western Europe, namely, in Galicia, Hungary, and in central Germany. There is little doubt that this type of soils occurs on the American continent where the prairies begin to be replaced by forests.

Sod and podzol soils.—The Russian term "podzol" very nearly corresponds with the German "Bleïsand" (lead sand), with this differerence, however, that the term is applied not only to sandy but also to more sticky, clayey soils if they have been affected to a marked degree by chemical leaching processes under the influence of the solvent action of humus acids. In the regions where podzol soils occur the climatic and other conditions are especially favorable to the decomposition and leaching of the soil constituents by the solvent and reducing action of the humus.

The upper horizon of the podzol is light gray or gray, frequently with a light cinnamon tint, and 1 to 1½ dcm. in depth. It has no marked structure, and its coherence varies with the content of clay, sand, and humus.

The underlying horizon is much lighter, sometimes almost white, sometimes with a yellowish or pale-blue tint. This is the podzol proper. It presents a mass of fine particles, flour-like in a dry state, sticky in a wet state, very rich in silica. The thickness (depth) of the podzol layer varies from a few centimeters to over 4 decimeters. The subsoil or the parent rock is most frequently red-brown sandy morainic clay with pockets of podzol, or argillaceous sand, but the subsoils may also be pebbly clays, feebly coherent and friable sands, clay or loamy yielding rocks, or even loess-like deposits.

When the second horizon is near the surface the whole soil is called podzol; when it is not individualized, indistinct, or entirely absent, a sod or peat soil results. Between the first and the second there exist in nature gradual transitions, as can be seen in northern Russia on every cultivated field and under every forest.

Concretions are ordinarily found in podzol soils in the form of bullet-like grains, small veins, or continuous layers in the lower part of the

second horizon or at the border between the latter and the parent rock.

The soils of this group occupy not less than two-fifths of the area of European Russia, the greater part of Poland being included. At the north they extend as far as Archangel and penetrate in strips and circumscribed areas into the borderland of the tundra soils. At the south they comprise parts of the governments of Perm, Kazan, Nijni Novgorod, Vladimir, Riazan, Kaluga, Oryol, Chernigov, Volyn, and Lublin, where they intermix with the forest subclays and the chernozem. Typical podzols are found especially in the governments of Mogilyov, Smolensk, Vitebsk, Tver, Novgorod, Pskov, and St. Petersburg.

In podzol soils which were once covered with woods and are now cultivated the content of humus is not large, varying from a few tenths of 1 per cent to 2 or 3 per cent, rarely more.[1] In the lower horizon the amount of humus rapidly falls to 0.1 to 0.3 per cent. The nitrogen fluctuates between 0.1 and 0.15 per cent in the upper horizon. The solubility of the humus is remarkably high. From soil of the upper horizon water extracts from one forty-eighth to one-twentieth of the total humus and of the lower horizon from one twenty-seventh to one-tenth. Nitric acid is often found in these extracts.

The soils contain on an average 95 to 97 per cent of mineral matter, of which 80 per cent and more is silica. The amount of zeolites usually does not exceed 10 to 12 per cent, frequently falling much lower (7 to 5 per cent); the amount of substances soluble in 1 per cent cold hydrochloric acid is rarely more than 2 per cent. The total quantity of phosphoric acid varies from 0.05 to 0.08 per cent, but is larger in soils containing a large amount of organic matter. The investigations of Kostichev have proved that in this case it is present mainly in combination with the humus. The absorptive capacity does not in general exceed 12 to 13 per cent.

The podzol soils vary widely, according to the nature of the parent rock. The composition of samples of three different horizons of a podzol soil from the Novgorod Government is given in the following table:

Composition of a podzol from the Novgorod Government.

	Humus.	Lime.	Magnesia.	Alumina.	Iron oxid.	Phosphoric acid.	Silica.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Upper horizon	2.8	1.172	0.378	7.032	1.84	0.085	81.02
Lower horizon (podzol proper)	.3	.790	.240	4.790	.67	.050	90.70
Subsoil	....	1.030	.340	7.210	1.62	Undetermined.	84.50

[1] If the upper horizon is turf-like it contains sometimes up to 15 per cent and more of partly decayed organic matter.

If the second horizon is near to the surface or the whole soil is transformed into podzol the land is, of course, very poor. In sandy soils the second horizon contains much less of the alkalis, lime, magnesia, iron oxid, alumina, and phosphoric acid than is found in clayey soils of this class.

The relation of sand to fine earth in podzol soils varies from 5:1 to 7:1. The capacity for water is only from one-half to two-thirds that of chernozem, while its permeability is 2 to 6 times as great. On the better class of podzol soils, when well provided with moisture, the crops, although not large, are more uniform and constant than on the chernozem, especially if well fertilized. In the true silty podzol, however, there is frequently more than 70 per cent of fine earth in the form of quartz dust. It absorbs moisture with avidity and retains it for a long time, turning into a sticky dough-like mass. On drying it breaks up into dust or hardens and forms crusts. This is one of the worst and most unproductive soils, both on account of its poverty in fertilizing constituents and of its unfavorable physical properties.

Soils of the podzol type are found in Siberia, northern Germany, France (the landes), Holland, Denmark, and Scandinavia, and North America (mainly in the British possessions).

Tundra soils.—The soils of the arctic tundra of European Russia and Siberia may be classified as rocky, turfy, clayey, and sandy. The level surface and the treeless condition of the tundra of the basins of the Petchora, Obi, and Yenisei Rivers impart to it a steppe-like appearance. The vegetation consists of lichens, mosses, Arctostaphylos, Andromeda, Empetrum, *Rubus chamæmorus*, Vaccinium, Carex, etc. *Betula nana* and the polar dwarf willows appear as almost the only representatives of bushes. The humus is crude and accumulates only in the surface horizon of the clayey or sandy soil, to a depth of 3 to 5 cm.; everywhere can be seen denuded places, surrounded by mosses or lichens. The temperature fluctuations are striking. The summer is very short; even in July the temperature falls at night to $+3^\circ$ C., and at the end of the month even to -2°; in August it snows, and soon the long winter, with its icy winds, begins. The perpetually frozen layer begins in the clayey tundra at a depth of 0.7 to 1 meter and in the sandy at a depth of about $1\frac{1}{2}$ meters. The turfy tundras are characteristic mounds of turf, frozen inside, which are 15 to 20 meters in length and 4 meters in height. The forest penetrates into the tundra from the south, along the river banks, where the perpetually frozen horizon is deeper than in other places.

INTRAZONAL SOILS.

Alkali soils.—Alkali lands are found in the southern part of European Russia, in southwestern Siberia, in the Transcaspian region, and in Turkestan. In the territory of the chernozem they occur in spots,

usually on the gently sloping southern declivities or on the slight depressions of the steppes. Sometimes these areas occupy dozens of square kilometers and contain saline lakes, but more frequently they are scattered over the steppes in small spots. In a vertical section of a chernozem alkali soil there are seen: (a) The upper horizon, black, dark gray, dark brown, or gray, sometimes homogeneous, sometimes pervaded by a whitish dust; from 1 to 3 dcm. deep; (b) a light gray or whitish horizon, 1 to 3 dcm. deep (sometimes almost absent), merging into (c) a brownish or yellowish compact and sticky clay.

On the surface of the alkali soil, especially after a rain, appear efflorescences or crusts consisting of whitish siliceous powder and minute saline crystals. The content of humus in the upper horizon is in general much less than in the adjacent chernozem, but sometimes reaches 8 per cent and more. The water extracts are colored light cinnamon or light cherry from the alkaline humates in solution. The solubility of the humus reaches one-seventieth in the upper horizon and one twenty-fifth in the second horizon (b), *i. e.*, it is twice or three times as great as in the chernozems. This is due to the greater humidity of the alkali soils and brings them into close relation with the soils of the podzol type. The whitish color of the lower horizon and the siliceous dust of the efflorescences and crusts is due to the same cause. Of the mineral salts soluble in water in the alkali soils of the chernozem zone there occur sodium carbonate, sodium sulphate, sodium chlorid, calcium sulphate, magnesium sulphate, and calcium bicarbonate. Many alkali soils are marly. The total amount of salts extracted by water varies according to Kostichev and others from 0.5 per cent to 5 per cent and more. With regard to physical characteristics, the alkali soils of the chernozem territory are distinguished by becoming very compact and hard upon drying.

The alkali soils of the dry steppes and of Turkestan are mostly yellowish and brownish in color, like the zonal soils which surround them, but dark colored alkali soils are also met with. The white incrustations consist of sodium sulphate, sodium chlorid, magnesium sulphate, calcium sulphate, and carbonates. Extensive alkali deserts without any cultivation whatever occur, as well as saline mud flats.

In general the alkali lands of European and Asiatic Russia bear a close resemblance to those of Hungary, India, Arabia, the western States of North America, Argentina, Australia, and other level and dry regions.

Humus-calcareous soils.—The soils which are formed from limestones and marls are frequently skeleton soils and contain little humus, especially if distributed over steep river banks and along ravines, but from the same parent rocks—soft limestones, chalk, and chalky marl—originate gray and dark gray soils, sometimes very rich in humus. In the southern part of Poland they attract especial attention, being in

marked contrast with the surrounding light gray podzol soils. They are known under the local terms of "rendzina" or "borowina." The upper horizon of the rendzina is most frequently gray, without a cinnamon tint, not rarely spotted with white undecomposed chalk; lower down the color becomes lighter and the soil gradually merges into the marly, sticky clay which is mixed with chalky gravel. Still lower lies the white parent rock—chalk or limestone. The content of humus varies from 3 to 5 per cent and more; its solubility from one one-hundredth to one one-hundred-and-thirtieth. The amount of calcium carbonate varies from 3 to 17 per cent and more. The clayey character of the mineral matter renders the soil sticky in wet weather and hard in a drought. However, lighter sandy rendzinas also occur.

Marsh or swamp soils.—Soils of this type extend largely throughout the whole northern half of Russia, but are of little economic importance. In the basin of the Pripet River they occupy more than 2,000 square kilometers. Throughout the podzol soil areas spots and strips of grassy marsh soils are formed under the influence of excessive stagnating water. The vegetation consists of species of Carex, Scirpus, Phragmites, Acorus, Menyanthes, Parnassia, Nasturtium, Ranunculus, Butomus, Sagittaria, etc. The roots of these plants penetrating into the slimy mineral rock oversaturated with water, give humus which slowly oxidizes and which accumulates in large amounts (4 to 20 per cent). The borders of the marshes are frequently cultivated and are known as "black earth" in contrast to the adjacent light sod and podzol soils.

The thickness of the dark-colored horizon varies from 2 to 8 and more decimeters. The solubility of the humus of the soil as a whole is not great ($\frac{1}{200}$ to $\frac{1}{270}$), but rapidly increases with the depth in the soil, being one-tenth at a depth of 1 meter. The abundance of moisture which dissolves humus acids favors the decoloration and leaching of the lower horizons of the soil, making them very similar to the podzols. Under the marshes are frequently found white, light gray, or bluish, and grayish-white slime, either clayey or sandy. The total quantity of nitrogen in the upper horizon varies from 0.3 to 4 per cent.

In the mineral part of the soil the proportion of the clay and sand is variable. Brown veins and concretions of limonite, vivianite, iron sulphid, etc., are usually present. A considerable amount of carbonate and sulphate of calcium are also characteristic of many marshy soils which contain animal remains (shells of mollusks, etc.).

INCOMPLETE OR AZONAL SOILS.

To this class belong the crude and skeleton soils originating from compact, pebbly, conglomerate, and sandy rocks, and morainic and alluvial soils, which are more or less widely distributed throughout

Russia. The Russian rivers, with the exception of some which flow through mountainous regions, overflow regularly in the spring. The alluviums which they deposit consist of sands, clays, and sandy or marly clays, containing some limonite, peat, vivianite, etc.

The prairie vegetation which springs up after the water has receded results in an accumulation in the upper horizon (soil proper) of varying quantities of humus.

The petrographic character of these soils approaches that of the soils from which the alluvium is derived—in northern Russia the podzols, in southern the chernozems.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

The qualitative detection of mineral phosphates in Thomas slag, N. VON LORENZ (*Ztschr. Landw. Versuchsw. Oesterr., 3 (1900), p. 684; abs. in Chem. Ztg., 24 (1900), No. 96, Repert., p. 355*).—A filter paper about 5 cm. in diameter is moistened with about 1 cc. of 5 per cent soda solution and spread over the convex side of a large watch glass which is suspended for about 5 minutes over a beaker in which 10 gm. of the Thomas slag has been stirred up with 30 cc. of concentrated sulphuric acid. The filter paper is then washed off into a beaker with 2 to 3 cc. of water and the solution tested for fluorin with calcium chlorid in presence of acetic acid. The presence of fluorin is taken to indicate the presence of mineral phosphates.

Estimation of alkali carbonates in the presence of bicarbonates, F. K. CAMERON (*Amer. Chem. Jour., 23 (1900), No. 6, pp. 471–486*).—Titration in the cold with a solution of acid potassium sulphate, using phenolphthalein as an indicator, is claimed to give satisfactory results in the examination of alkali soils. The reaction which occurs is as follows: $Na_2CO_3 + HKSO_4 = HNaCO_3 + NaKSO_4$. The reaction products are neutral to ordinary indicators. Chlorin may be determined in the solution after the determination of the carbonate by adding a slight excess of the sulphate and titrating with silver nitrate solution, using potassium chromate as indicator. The method also seems to be adapted to the determination of silicates, borates, phosphates, and the salts of weak acids in general.

Methods of determining proteid nitrogen in vegetable materials, G. S. FRAPS and J. A. BIZZELL (*North Carolina Sta. Bul. 174, pp. 95–104*).—The authors report a study of phospho-tungstic acid and bromin as precipitants for the proteids of vegetable materials. The phospho-tungstic acid method as proposed by Mallet and the bromin method as proposed by Wiley for animal materials (E. S. R., 10, p. 819) were modified and compared in a series of determinations with the copper hydroxid method as proposed by Stutzer and adopted by the Association of Official Agricultural Chemists. A variety of vegetable and animal materials were used in the comparative determinations. Tests were made of the effect of temperature and of the quantity of

the reagent used in the phospho-tungstic acid method. Zinc sulphate as a precipitant of proteids was also compared with the reagents on several materials. The following conclusions are drawn:

"Phospho-tungstic acid does not precipitate proteids completely at 90 or 100° C.

"With phospho-tungstic acid as the precipitant, at 60°, very nearly the same results are obtained on vegetable materials as by the Stutzer method.

"Bromin is not a suitable precipitant for proteids in vegetable materials.

"The Stutzer method seems to be the method least open to objections."

A new method for the determination of nitric nitrogen, J. F. Pool (*Jour. Pharm. et Chim., 6. ser., 11 (1900), No. 6, p. 285; abs. in Ann. Agron., 26 (1900), No. 11, p. 585*).—The solution containing the nitrate is evaporated to dryness with sodium chlorid and decomposed with sulphuric acid in an atmosphere of carbon dioxid. The hydrochloric and nitric acids thus formed react upon each other, liberating chlorin according to the following formula:

$$6HCl + 2HNO_3 = 2NO + 4H_2O + 3Cl_2.$$

The chlorin is driven off from the solution, after dilution, and conducted into a solution of potassium iodid, the iodin set free being determined by titration with sodium hyposulphite. From the data thus obtained the nitrogen present is calculated by means of the above equation.

Estimation of nicotin, amount of nicotin in New South Wales tobaccos, G. Harker (*Chem. News, 81 (1900), p. 273; abs. in Jour. Chem. Soc. [London], 78 (1900), No. 457, II, p. 778*).—Comparative tests were made of the methods of Kissling and Biel. The original forms of these methods gave similar results, but the modification of Biel's method involving the weighing of the double sulphates of nicotin and ammonia did not give satisfactory results. The same was true of attempts to estimate nicotin volumetrically in the presence of ammonia. No loss of nicotin was observed during the evaporation of its solutions in ether. Four varieties of New South Wales tobacco examined gave the following percentages of nicotin: Manila, 1.95; Tamworth, 2.36; Tumut, 3.84; and Bathurst, 4.53.

The adulteration and analysis of the arsenical insecticides, J. K. Haywood (*Jour. Amer. Chem. Soc., 22 (1900), No. 9, pp. 568–582*).—The author reviews the work reported by a number of the experiment stations on the composition and adulteration of insecticides and reports trials of a number of methods of analysis that have been suggested. His conclusions are as follows:

"(1) Water can be determined in Paris green and Scheele green by drying at the temperature of boiling water for 12 to 15 hours.

"(2) The best method for determining the total arsenious oxid in Paris and Scheele greens is the Thorn-Smith method [E. S. R., 11, p. 614].

"(3) The best method for determining the soluble arsenious oxid in Paris and Scheele greens is by extracting with 500 cc. of water at room temperature.

"(4) Hot water extraction can not be used to extract soluble arsenious oxid.

"(5) A good method for determining copper in Paris and Scheele greens is the volumetric method based on the titration of the iodin set free from potassium iodid by a copper salt in acetic acid solution."

Composition and analysis of London purple, J. K. HAYWOOD (*Jour. Amer. Chem. Soc., 22 (1900), No. 12, pp. 800–809*).—The author finds London purple to consist of calcium arsenite, calcium arsenate, and an organic dye.

After a trial of several methods of analysis the following was found very satisfactory in determining the arsenic in London purple: Two grams of substance is dissolved in 80 cc. water, 20 cc. hydrochloric acid added at 60 or 70°, and the whole filtered and washed to a volume of 300 cc. An aliquot of 100 cc. is treated with sodium carbonate in excess and made up to 500 cc., using a few drops of ether to destroy bubbles; 250 cc. of this solution is filtered, starch solution added and a standard iodin solution until the blue color appears. The result represents the arsenious oxid as such in 50 cc. of the original solution or in $\frac{1}{3}$ gm. substance.

To determine the total amount of arsenic 50 cc. of the original solution, representing $\frac{1}{3}$ gm. of substance, is heated in a water bath to 80°, after which 50 cc. of hydrochloric acid and 3 gm. of potassium iodid are added. After standing 15 minutes the arsenate is reduced to arsenite by the action of the potassium iodid, the iodin being set free. The solution is then rinsed out in a large beaker and tenth-normal sodium thiosulphate added, drop by drop, to get rid of the iodin. On account of the dark color the end point is hard to read without practice. Tests are made from time to time with a drop of the solution on starch paste. After the operation is completed the solution is immediately made alkaline with solid sodium carbonate, again made slightly acid with hydrochloric acid and finally alkaline with sodium bicarbonate. Starch paste is now added and deci-normal iodin until the blue color appears. The figure thus obtained gives the total amount of arsenic present as arsenious oxid.

Methods are also given for determining the calcium oxid and the soluble arsenious and arsenic oxids in London purple.

Detection of coal-tar dyes in fruit products, A. L. WINTON (*Jour. Amer. Chem. Soc., 22 (1900), No. 9, pp. 582–588*).—The author mentions the increased use of coal-tar colors in the preparation of fruit jellies (frequently artificial), fruit preserves, soda-water sirups, etc. In the absence of special methods for detecting these, he has adapted a number of methods originally devised for wines. Working descriptions are given for Arata's wool test, the amyl alcohol tests (alkaline solution and acid solution), Girard's tests for acid fuchsin, and Cazeneuve's method, together with precautions which have been learned by experience.

The main reliance is based upon Arata's test, the other tests mentioned being employed either to confirm the results or to supply evidence in cases where that test fails. This is made by boiling 100 cc. of the liquid to be tested for 10 minutes with 10 cc. of 10 per cent potassium bisulphate and a piece of white wool or woolen cloth which has been previously heated to boiling in a very dilute solution of sodium hydrate, and thoroughly washed with water. If after washing the wool with boiling water and drying, it remains dyed and the color is not changed by ammonia, or if changed is restored by washing, coal-tar dyes, chiefly of the azo-group, are indicated.

The influence of carbon bisulphid and common salt on the losses of nutrients and the character of the fermentation of ensiled fodders, I. KALUGIN and S. PARASHCHUCK (*Zap. Novó-Alexandri Inst. Selsk. Khoz. i Lyesov., 1899, pp. 39; abs. in Selsk. Khoz. i Lyesov., 196 (1900). Feb., p. 470, 471*).—The experiments were made with red clover, cabbage, and fodder carrots, which were stored in excavations in the ground. The close packing of the fodders was found to aid their preservation, the structure of the fodders being maintained and an agreeable odor produced; the loss of organic substances was reduced except that of proteids, whose decomposition was considerably increased. Close packing caused an increase in the formation of free organic acids. Loose packing, on the other hand, was not favorable to preservation, the structure of the fodder being lost, the fodders becoming covered with mold and acquiring a disagreeable odor, and the loss of organic substances increasing except in the case of proteids. The addition of carbon bisulphid contributes to a fine preservation of both closely and loosely packed fodders. Their structure is maintained and they acquire an agreeable honey-like odor after the carbon bisulphid has evaporated. The addition of carbon bisulphid considerably diminishes the loss of all organic nutritive substances, especially when the fodder is loosely packed, and arrests in a considerable measure the development of free organic acids.—P. FIREMAN.

On carnosin, a new organic base of meat extract, W. GULEWITSCH and S. AMIRADŽIBI (*Ber. Deut. Chem. Gesell., 33 (1900), No. 12, pp. 1902, 1903*).

Qualitative test for boracic acid, E. W. and M. L. WADE (*Jour. Amer. Chem. Soc., 22 (1900), No. 9, p. 619*).—This depends upon the characteristic red color imparted to turmeric paper by the vapor resulting from boiling 0.1 gm. of the substance with 0.5 cc. of hydrochloric acid and 10 cc. of wood alcohol.

Paris green and London purple in Montana, F. W. TRAPHAGEN (*Montana Sta. Bul. 25, pp. 7*).—The author made analyses of 6 samples of Paris green and 2 samples of London purple bought of dealers in the State. It was found that arsenious oxid was present in Paris green in the proper proportion and nearly all in an insoluble form, the largest amount of soluble arsenious oxid in any sample being 1.29 per cent. Of the 2 samples of London purple which were analyzed 1 contained 50.89 per cent combined arsenious oxid, 0.54 per cent free, while the other contained 34.51 per cent arsenious oxid combined and 2.67 per cent free.

Estimation of fat in condensed milk, A. E. LEACH (*Jour. Amer. Chem. Soc., 22 (1900), No. 9, pp. 589–591*).—The author describes a modified form of the Babcock test for use where sugar has been added, which has proved not only much quicker than the method of extraction and easier of manipulation, but also more accurate. In this method the proteids are precipitated with copper sulphate solution and separated by whirling in a centrifuge, carrying down the fat also, and the supernatant liquid pipetted off. After washing the precipitated proteids and fat twice by shaking with water, the Babcock test is made as usual, the reading being multiplied by 1.8 to give the percentage of fat.

A rapid method for the detection of "aniline orange" in milk, H. C. LYTHGOE (*Jour. Amer. Chem. Soc., 22 (1900), No. 12, pp. 813, 814*).—The name "aniline orange" is used to designate all azo-colors used in coloring milk. The use of these coloring matters in milk is found to be on the increase, and the following method is submitted for detecting them: To about 15 cc. of milk in a casserol, add an equal amount of hydrochloric acid (sp. gr. 1.20) and thoroughly mix, breaking up the curd into rather coarse lumps. If aniline orange is present, the curd will be colored pink.

A simple method for determining alum in wine, F. LOPRESTI (*Staz. Sper. Agr. Ital., 33 (1900), pp. 373–377; abs. in Chem. Centbl., 1900, II, No. 24, p. 1216*).—Alum is sometimes added to a poor wine to cover or to improve its character. To determine the presence of alum, concentrate 50 cc. of the wine to $\frac{1}{3}$ of its volume, decolorize with animal charcoal, neutralize the filtrate with sodium or potassium hydrate, make up to 50 cc., and test the solution with a drop of freshly prepared logwood. If the wine is free from alum the solution will be orange yellow; if alum is present the solution will be violet or blue.

Detection of foreign coloring matter in spirits, C. A. CRAMPTON and F. D. SIMONS (*Jour. Amer. Chem. Soc., 22 (1900), No. 12, pp. 810–813*).—A method by the same authors has been previously noted (E. S. R., 11, p. 312). The present method is found to be a much more satisfactory and convenient test. The 2 foreign substances used in coloring spirits are caramel and prune juice, and this method is based upon the insolubility of these coloring matters in ether. Details and tests of the method are given.

Determination of the acidity of flours, H. KREIS and C. ARAGON (*Jour. Suisse Chim. Pharm., 38 (1900), p. 64; abs. in Bul. Assoc. Belge Chim., 14 (1900), No. 5, p. 232*).

Recent studies on the solubility of lime in sugar solutions, J. WEISBERG (*Bul. Soc. Chim. Paris, 3. ser., 23 (1900), No. 18–19, pp. 740–745; abs. in Chem. News, 82 (1900), No. 2142, pp. 284, 285*).—Determinations of the solubility of lime in different forms at ordinary and at high temperatures are reported. Even at temperatures of 80 to 90° C. the solubility was considerable—much greater, in fact, than that found by Lamy.[1]

Sixth annual report of the Michigan dairy and food commissioner (*Michigan State Dairy and Food Com. Rpt. 1899, pp. 237*).—This volume contains the commissioner's report and the usual statistics of inspections, analyses, and prosecutions under the State pure-food law, as well as a financial statement, report on cheese factories and creameries, and a digest of laws and opinions.

Report of the chemical division, B. C. ASTON (*New Zealand Dept. Agr. Rpt., 1900, pp. 127–137*).—Complete or partial analyses were made of a number of samples of soils, waters, fertilizers, seed of *Chenopodium album*, sugar, crystallization preventive, vinegar, etc. Liquor obtained from a silo press was examined and found to contain 9.7 per cent of soluble albuminoids.

[1] Sucr. Indig. et Coloniale, 11 (1876–77), p. 234–237.

BOTANY.

Recent investigations concerning the effect of perchlorates on the growth of crops, P. DE CALUWE (*Orgaan Ver. Oudleer. Rijks. Landbouwschool, 12 (1900), No. 143, pp. 105–109, figs. 3*).—During recent years it has been noted that grain fields, especially rye, are more or less seriously injured when fertilized with nitrate of soda containing perchlorates. The plants thus poisoned remain stunted; the leaves are short, stiff, and twisted, and the color is a very dark green. It has been a matter of dispute whether the injury was due to perchlorate of soda or of potash, though the evidence points to the former as the principal cause of the disease. The experiments carried on by the author in 1898 and 1899 demonstrated that sodium perchlorate is more injurious than potassium perchlorate.

For all of the experiments except one a field of rye that had been sown in the fall of 1898 was selected. This was cut up into plats and treated with sodium nitrate and with varying amounts of perchlorates of soda and of potash. There were (1) plats on which no fertilizer was used; (2) those to which only sodium nitrate was applied, and (3) those that received sodium perchlorate or potassium perchlorate without sodium nitrate. In the first series of experiments mixtures of 1, 2, and 3 per cent of the perchlorate and chlorate of potash with sodium nitrate were used. Check plats in each series received the equivalent of 2 per cent chlorate and perchlorate, but no nitrate of soda. The fertilizer was applied February 23, 1899, and in April the symptoms of perchlorate poisoning were clearly evident. The plats treated with chlorate did not show the symptoms of perchlorate poisoning, but the leaves were pale and etiolated in spots. The plats receiving chlorates and perchlorates, but no nitrate, showed very few symptoms of either the perchlorate or chlorate poisoning, although the growth was weak, owing to the absence of nitrates. The plats treated with sodium nitrate alone gave an increase of 31 to 33 per cent over the untreated plats, those to which chlorates as well as nitrate had been applied gave an increase of only 4 to 7 per cent, while on the 2 plats treated with perchlorates and nitrate there was a decrease in yield. The possible good effect of the nitrate was counteracted by chlorate and perchlorate, and the injurious effect of the latter was shown to be greater than that of the former.

The tests to determine the effects of sodium perchlorate were carried on at the same time and in a similar manner, except that twice as many plats were used and the percentages of perchlorates for the different plats varied from 0.75 to 2.6 per cent. Two plats were given perchlorate without nitrate. The injurious effects of the perchlorates were evident before the end of March. As compared with the plats treated with nitrate of soda alone the plats that received sodium per-

chlorate gave a decrease of from 3 to 50 per cent. Where only 0.75 per cent of perchlorate was used the poisonous effect was evident and the crop 3 per cent smaller than on the check plats. The plats treated with perchlorates without nitrates gave only half a crop, although the plants did not appear as badly injured as did those of some of the other plats. In November some plats were treated with sodium perchlorate, others with potassium perchlorate mixed with nitrates. The injurious effect was soon apparent, even when only 0.64 per cent of sodium perchlorate had been used, but in this case the plants eventually outgrew the effects of the poison. When 2 to 3 per cent of sodium perchlorate was used many of the plants were killed. The effect of the potassium perchlorate was ultimately outgrown, even when as much as 3 per cent of it had been mixed with nitrate of soda.

Experiments on turnips followed by rye showed that turnips are poisoned by perchlorates and that more than one crop may be injured by an application of nitrate of soda containing perchlorate. Oats and corn are also liable to injury, but do not suffer as seriously from it as rye.—H. M. PIETERS.

Electricity in plant culture (*Nature, 61 (1900), No. 1590, p. 602*).—A brief account is given of experiments conducted in Russia by Spyeshneff and Kravkoff. The former reported results of the well-known experiments with electrified seeds, in which he ascertained that such seeds germinated more rapidly and gave yields from 2 to 6½ times higher than seeds not subjected to the preliminary electrification. In another series of experiments copper and zinc plates were placed vertically in the soil and connected by wires. Potatoes and roots grown in the space between gave crops 3 times heavier than those grown in the test plat at the side.

In a third series of experiments by this author wooden posts were planted about 10 yards apart and provided at their tops with metal aigrettes connected by wires, so as to cultivate his plants under a network of wires. Among the most striking results obtained in this experiment was in the ripening of barley, which was accelerated 12 days.

The other investigator undertook a series of laboratory experiments upon bags of soil submitted to electric currents. The temperature of the soil was raised by these currents. Its moisture at first decreased, but afterwards increased to a considerable degree, and finally it is claimed the amount of vegetable matter in the soil was increased by the electric current.

On the embryo of mummy wheat and barley, E. GAIN (*Compt. Rend. Acad. Sci. Paris, 130 (1900), No. 24, pp. 1643–1646*).—An account is given of a number of investigations on specimens of wheat and barley which were taken from ancient tombs and are probably from 4,000 to 6,000 years old. Transverse and longitudinal sections were made of a large number of grains to ascertain what changes they had under-

gone. The author states that in order to have the seed germinate, it is necessary that the reserve material shall remain chemically unchanged, that the embryo shall preserve its structure, that an enzym be present for the reduction of the reserve material and that the embryo shall remain in contact with the reserve material for the proper transfer of the elaborated reserve material. Examination of a large number of specimens failed to show a single instance in which the embryo remained in contact with the reserve material. The embryo maintained its cellular structure, but had undergone very decided chemical changes. The scutellum and the rest of the embryo had become a reddish-brown color, and numerous microchemical reactions gave very different results for the embryos of the mummy cereals and those of more recent ones. The reserve material had apparently undergone no chemical change.

In conclusion it is stated that these mummy cereals, although exteriorly in a fine state of preservation, did not possess the necessary organization for germination. Their reserve material had been chemically unchanged and was capable of utilization by a viable embryo, but the embryos in every case were so transformed as to be without the ability to grow. This chemical alteration seems to have taken place at a very remote period. It is the author's expectation to compare specimens of these mummy cereals with others less old to ascertain just what changes have taken place.

Injuries to plants by London fogs and smoke, G. HENSLOW (*Garden, 57 (1900), No. 1487, pp. 353, 354*).—An account is given of the injury caused by fog and smoke to plants, particularly in greenhouses, in the vicinity of London. The most important and harmful ingredients of fog and smoke are said to be carbon, hydrocarbon derivatives, and sulphurous acid. One of the sources of injury is in the deposition of carbonaceous matter on the glass whereby the light is shut off. In similar ways the transpiration of the plant is largely affected, and both mechanical evaporation and transpiration are greatly impeded. The poisonous ingredients of fog are chiefly sulphurous acid and vaporized hydrocarbons which pass into the houses and injure the foliage of plants. The author says: "The amount of sulphurous acid has been found in analyses in dull weather in London to be ordinarily about 6 parts per cent (?), and in a thick yellow fog it amounts to about 20 per cent" (?). Artificial experiments with various amounts of sulphurous acid in water produced precisely the effect that was produced by the fog. The protoplasm of the plants was destroyed, a decomposition of chlorophyll grains and the formation of chlorophyllan taking place. Experiments with a number of hydrocarbon derivatives have shown similar effects, pyredin causing a rapid destruction of protoplasm, a limpness of the leaves, and subsequent browning. The action of these substances is usually first noticed upon the flowers. If the buds have expanded, the flowers become checked

and smaller, while if the injury takes place at a period just preceding the opening of the flowers, the flowers become yellow by the formation of chlorophyllan, and brown by the presence of tannins. In some cases buds are severely injured while expanded flowers are unaffected. In general, all flower buds opening during a fog perish.

Outlines of plant life, C. R. Barnes (*New York: Henry Holt & Co., 1900, pp. 308, figs. 250*).—An abridged edition of Plant Life by the same author (E. S. R., 10, p. 416).

Some native forage plants of the State, E. V. Wilcox (*Montana Sta. Bul. 22, pp. 54–56*).—Notes are given upon a number of indigenous forage plants which are valuable as forage or for hay. Among those mentioned are sagebrush, wild licorice, wild geranium, five-finger, lupines, and vetches. In addition, sweet clover is said to have been introduced and become quite abundant in a number of localities.

Some new species of the genus Cratægus and notes on some dichotomous Panicums, W. W. Ashe (*North Carolina Sta. Bul. 175, pp. 109–116*).—Descriptions are given of 21 new species of Cratægus and 7 new species of Panicum, belonging to what is known as the Dichotomous group.

The importance of the green leaf for the life of the plant, Z. Kamerling (*Reprint from Arch. Java Suikerind. 1900, No. 5, pp. 20, pls. 3*).—A lecture delivered in which is presented the general subject of the rôle of chlorophyll in plant life.—H. M. P.

Flowers and fruits of common trees and shrubs, F. H. Hillman (*Nevada Sta. Bul. 46, Nature Studies 2, pp. 15, figs. 24*).—The general structures of flowers and fruits are described and the flowers and fruits of a number of the more common trees and shrubs are figured and discussed.

Nuclear phenomena in certain stages in the development of the smuts, R. A. Harper (*Trans. Wisconsin Acad. Sci., Arts, and Letters, 12 (1900), pt. 2, pp. 475–497, pls. 2*).

The resin ducts and strengthening cells of Abies and Picea, H. B. Dorner (*Proc. Indiana Acad. Sci. 1899, pp. 116–129, figs. 11*).—Studies are reported on the structure of the leaves of the native species of fir and spruce, in which diagnostic characters are sought in the resin ducts and strengthening cells occurring in them.

Caoutchouc-yielding plants, P. Van Romburgh (*Teysmannia, 9 (1900), No. 7, pp. 342–345*).—The author mentions 4 species of Urceola as producing caoutchouc of good quality but in small quantity. *U. brachysepala* grows in 8 or 9 years to a height of 13 meters with a stem circumference of 30 cm. From 2 average plants of this species he obtained 50 gm. of caoutchouc. *U. javanica* is characterized by its large horn-shaped fruits, the weight of which is said to be so great that they sometimes break down the trees upon which the plant finds support. This is a serious objection to the cultivation of the plant. *U. elastica,* which grows to great size, and *U. maingaiji* each yield small quantities of good caoutchouc.—H. M. P.

The influence of the assimilable nitrogen in the soil on the activity of the root tubercles of leguminous plants, Bruhne (*Landw. Wchnschr. Prov. Sachsen, 2 (1900), No. 46, p. 423*).—A brief article describing, in a popular manner, the results obtained by different investigators.

Influence of weather conditions on the root tubercles of leguminous plants, Bruhne (*Landw. Wchnschr. Prov. Sachsen, 2 (1900), No. 45, pp. 412, 413*).—These notes, based on the work of Nobbe and Hiltner, treat of the relation between the transpiration of the plant and the activity of the root tubercles of legumes. The author concludes from the results obtained by these investigators that leguminous plants for green manuring should be sown in season to allow them to develop sufficiently to insure activity of the root tubercles.

ZOOLOGY.

The food of the bobolinks, blackbirds, and grackles, F. E. L. BEAL (*U. S. Dept. Agr., Division of Biological Survey Bul. 13, pp. 77, figs. 6*).—In this bulletin the author discusses the food habits of the bobolink, cowbird, yellow-headed blackbird, red-winged blackbird, California red-winged blackbird, rusty blackbird, Brewer's blackbird, crow blackbird, and boat-tailed grackle.

It is stated that a study of the stomach contents of blackbirds confirms to some extent the popular estimate of their grain-eating habits, but shows also that these birds destroy large quantities of seeds of noxious weeds and a great number of insects. In general, it was found that the vegetable portion of the food exceeded the animal portion and that the latter consisted mainly of insects. The vegetable food comprised for the most part grain, grass, and weed seeds. The author states that the animal food of the 9 species of blackbirds must be considered for the most part in their favor, as the insects eaten are injurious.

Of bobolinks, 291 stomachs were examined, coming from 19 States and taken during 5 months from May to September. The food consisted of 57.1 per cent animal and 42.9 per cent vegetable matter. Most of the stomachs were collected in Northern States, but the author believes that the great damage done by bobolinks to the rice crops is due to the immense numbers of bobolinks and the fact that the rice fields lie in the direct course of their spring and fall migrations. It is concluded that the harm done by the bobolink far outweighs its benefits.

Of the cowbird, 544 stomachs were examined from 20 States, taken during every month of the year. The animal matter contained in these stomachs was 22.3 per cent, while the vegetable matter was 77.7 per cent. Corn, wheat, oats, and buckwheat were found in the stomachs, grain as a whole amounting to 16.5 per cent of the food of the year. Weed seeds amounted to 60 per cent of the whole food. The author summarizes the results of the investigation of this bird as follows: Twenty per cent of the cowbird's food consists of noxious insects; 16 per cent of grain, about half of which is waste grain; while more than 50 per cent consists of noxious weed seeds.

Of the yellow-headed blackbird, 138 stomachs were received from 10 States during 7 months. The food consisted of 33.7 per cent animal and 66.3 per cent vegetable matter. Grain, collectively, amounted to 38.9 per cent of the total food. While a considerable portion of this grain was undoubtedly waste, the bird may evidently do great damage to grain fields. The author concludes that this species feeds principally upon insects, grain, and weed seeds, that in general it does much good by destroying noxious insects and troublesome weeds, but that where grain is very abundant it may be injurious to such crops.

Of the red-winged blackbird, 1,083 stomachs were collected from 30

States during a whole year. The food consisted of 73.4 per cent vegetable and 26.6 per cent animal matter. Grain, collectively, amounted to 13.9 per cent of the food of the year, but it appeared that half of this was waste grain. Weed seed was apparently the favorite food of this bird, as the total amount of grass and weed seeds constituted 54.6 per cent of the year's food. The author concludes that judging by stomach contents the red-winged blackbird is a very useful bird.

Of the California red-winged blackbird, 61 stomachs were examined and of the total food 1.6 per cent was animal matter, while 98.4 per cent was vegetable matter and mostly grain. It would appear from these facts that this species may do great damage where it is abundant in grain-growing sections.

Of the rusty blackbird, 132 stomachs from 16 States were examined. The stomachs contained 53 per cent of animal matter. Corn was found to be the favorite grain food of this bird and constituted 17.6 per cent of the year's food. Grain, collectively, amounted to 24.4 per cent of the food for the year. The author believes from a study of this bird that the animal food is always preferred when available.

Of the Brewer's blackbird, 146 stomachs were examined from 6 States. The animal matter constituted 31.8 per cent and the vegetable matter 68.2 per cent of the food. Grain collectively amounted to 60.3 per cent of the total food for the year. Although this record is against Brewer's blackbird, the author states that comparatively few complaints have been received regarding the injuries of this species to grain fields.

Of the crow blackbird, 2,346 stomachs were examined, of which 37 contained traces of birds' eggs and 1 contained the bones of a young bird. The food as a whole comprised 30.3 per cent animal and 69.7 per cent vegetable matter. Insects constituted 27 per cent of the entire food for the year. Corn, oats, wheat, rye, and buckwheat were found in the stomachs of the crow blackbird, corn being evidently the grain preferred by this species. Among the large number of stomachs examined, 456 were of nestlings, the food of which consisted of 74.4 per cent animal and 25.6 per cent vegetable matter. Insects amounted to 70 per cent of the total food of the nestlings, while corn constituted 15 per cent of the total food. The author concludes from the examination of these stomach contents that the crow blackbird is a useful bird and one against which no general war of extermination should be waged.

Of the boat-tailed grackle, 116 stomachs taken in every month of the year were examined. The food comprised 39.8 per cent animal and 60.2 per cent vegetable matter. Grain constituted 46.8 per cent of the total food, and of this all but a mere trace was corn. The author concludes that wherever this grackle is abundant it may become very injurious to the corn crop.

In connection with nearly all the species discussed the author insists upon the fact that the feeding habits of blackbirds are during the greater portion of the year beneficial, and that the damage to grain crops is for the most part confined to limited seasons, and is especially noticeable where the birds congregate in great numbers.

Results of the biological reconnoissance of the Yukon River region, W. H. OSGOOD and L. B. BISHOP (*U. S. Dept. Agr., Division of Biological Survey, North American Fauna No. 19, pp. 100, pls. 7*).—This bulletin treats of the following subjects: Itinerary; a description of the faunal districts of the Yukon River region; a review of previous work done in this region; an annotated list of species and subspecies of mammals, some of which are described as new. The foregoing subjects are by W. H. Osgood while L. B. Bishop contributed an annotated list of the species of birds found in the region under discussion.

Scientific names in natural history, K. SAJO (*Prometheus, 11 (1900), Nos. 547, pp. 417–420; 548, pp. 433–437*).—The author criticises the habit of forming several specific names in the same genus which have the same significance, although possessed of a different form. The publication of specific descriptions in little known periodicals or those having a small circulation is also criticised. The author believes that this habit is partly responsible for the undue multiplication of synonyms.

The jackal plague (*Agr. Jour. Cape Good Hope, 17 (1900), No. 9, pp. 525–528*).—Brief notes on the extent of the depredations committed by jackals and foxes upon the sheep industry.

The value of birds to the commonwealth, F. M. CHAPMAN (*Connecticut State Bd. Agr. Rpt. 1899, pp. 76–113, figs. 30*).—Brief popular notes on the economic relations of a number of common species of birds.

A report on the family of bee-eaters (Meropidæ), K. A. SATUNIN and F. F. KAVRAISKI (*Trudi Kavkaz. Shelkovod. Stantzii (Tiflis), 9 (1900), No. 2, pp. 33*).—The authors investigated the feeding habits of *Merops apiaster* and *M. persicus*, the 2 common European species of bee-eaters. Extended observations were made on these birds at the apiary connected with the sericultural station, and a report is made on the number of bees found in all the stomach contents which were examined, and upon other insects which were found to serve as the food of these birds. Observations are recorded from a number of correspondents in the different governments of Russia on the habits of the 2 species of birds in different localities. A map is given, showing the distribution of the birds in Russia.

Methods of destroying injurious animals, H. L. A. BLANCHON (*L'Art de détruire les animaux nuisibles. Paris: J. B. Baillière & Son, 1899, pp. 292, figs. 112*).—In this book the author has brought together and discussed in a summary manner the various methods which have been recommended for destroying noxious animals of all kinds. The volume contains a consideration of the following subjects: General methods of destruction and legislation against injurious animals; and special methods adapted for the destruction of injurious mammals, birds, reptiles, insects, crustacea, mollusks, and worms. Injurious insects are discussed under the headings of insects injurious to furniture, clothes and carpets, man and domestic animals, and field and garden crops.

Information concerning game: Seasons, shipment, and sale, T. S. PALMER and H. W. OLDS (*U. S. Dept. Agr., Division of Biological Survey Circ. 31, pp. 20*).—This circular contains a copy of the Lacey Act, a tabulated statement concerning the close seasons, the shipment of dead and live game, and the sale of game in the different States.

Wild animals and birds which may be imported without permits, J. WILSON (*U. S. Dept. Agr., Division of Biological Survey Circ. 30, p. 1*).—This circular contains a list of mammals, birds, and reptiles which may be imported freely without permits.

Laws regulating the transportation and sale of game, T. S. PALMER and H. W. OLDS (*U. S. Dept. Agr., Division of Biological Survey Bul. 14, pp. 89, pls. 9*).—This bulletin contains a compilation of the sections of various State laws which relate to the transportation and sale of game, and also tables and diagrams showing close seasons, species prohibited from shipment or sale, limits of game bags, and regulations concerning nonresident licenses.

METEOROLOGY—CLIMATOLOGY.

Monthly Weather Review (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 28 (1900), Nos. 7, pp. 279–320, pls. 3, figs. 2, charts 8; 8, pp. 321–370, figs. 4, charts 8; 9, pp. 371–424, fig. 1, charts 13*).—In addition to the usual reports on forecasts, warnings, weather and crop conditions, meteorological tables and charts for the months of July, August, and September, 1900, these numbers contain the following articles and notes:

No. 7, special contributions on Fog studies on Mount Tamalpais (illus.), by A. G. McAdie; Electric phenomena in the Euphrates Valley (illus.), by E. Huntington; Sudden disappearance of ice on the lakes, by H. H. Ten Broeck; Meteorological notes from Porto Rico, by R. M. Geddings; Forecasting for the farmer, by C. D. Reed; and Thunderstorms near Washington, by H. W. and H. S. Cragin; and notes by the editor on electric phenomena in the Euphrates Valley, notable lightning, the French edition of the Monthly Weather Review, Rafinesque on atmospheric dust, lightning from a cloudless sky, Weather Bureau station on Turks Island, wells and storms, the frequency and extent of destructive hail, atmospheric conditions favorable to cotton spinning, aurora in Florida, and progress in wireless telegraphy.

No. 8, special contributions on Nile floods and monsoon rains (E. S. R., 12, p. 424); Meteorological observations during the burning of the plant of the Standard Oil Company at Bayonne, N. J., July 5, 6, and 7, 1900, by W. H. Mitchell; Observations for local thunderstorms at Skyland, Page County, Va., August, 1900 (illus.), by H. W. and H. S. Cragin; Climatology of St. Kitts, W. I., by W. S. Alexander; and The hot weather of August, 1900 (illus.), by A. J. Henry; and notes by the editor on Weather Bureau men as instructors, monthly statement of average weather conditions, meteorological records in Ohio, climatological atlas of the Russian Empire, the influence of the Lakes on temperature of the land, and hydrography of Nicaragua.

No. 9, special contributions on Thunderstorms at Antigua, W. I., by W. H. Alexander; The storm waves of South Carolina and Texas, by E. P. Alexander; The Weather Bureau of Japan, by F. B. Wright; The color and the polarization of blue skylight, by N. E. Dorsey; Observations for local thunderstorms at Skyland, Page County, Va., September, 1900, by W. H. and H. S. Cragin; Meteorological observations at Eagle, Alaska, by A. J. Henry; Results of a balloon ascension at St. Petersburg, May 20–June 1, 1878, by M. Rykatcheff; The Gulf stream myth, by H. M. Watts; A review of Professor Very's memoir on atmospheric radiation, by N. E. Dorsey; and Monthly statement of average weather conditions for September, by E. B. Garriott; and notes by the editor on standard time, the frequency of hail in the United States, the crop as depending on meteorological conditions, and meteorological report from Nome, Alaska, September, 1900.

Report on the international cloud observations, F. H. BIGELOW (*U. S. Dept. Agr., Weather Bureau Rpt. 1898–99, II, pp. 787, pl. 1, figs. 32, charts 73*).—This report gives the detailed results of cloud

observations in cooperation with the International Cloud Commission at 15 different places in the United States during the period from May 1, 1896, to July 1, 1897:

"In order to submit these results to a careful discussion, it has been necessary to prosecute a critical comparative study of several important theories heretofore proposed by meteorologists, so that the comparison between observations and theoretical computations can be suitably carried out. Accordingly, a standard mathematical system has been constructed, including in a definite notation the constants, the thermodynamic, and the hydrodynamic formulæ pertaining to the atmospheric physical processes and motions, by means of which the work of the several authorities can be reduced to one set of typical equations. The theories of the American and the German schools of meteorology have been contrasted, and the results derived from them have been compared with the facts obtained from these cloud observations. The grouping of the data secured by the theodolites and the nephoscopes has been so carried out as to make such a comparison simple and direct, the outcome being interpreted to mean that a modified theory of atmospheric motions is required to explain the local anticyclonic and cyclonic circulations, while the theory of the general cyclone, though partially sustained, also needs improvement in several important details. Furthermore, the thermodynamic processes have been submitted to a rigorous computation, especially in connection with cumulus clouds, by means of which the limits of the four standard stages, and the mean gradients of pressure, temperature, and vapor tension within each stage, have been carefully determined. The construction of this system of computation has put us in possession of a method of discussing several important fundamental characteristic features of the atmosphere, and it is evident that a continuation of research along these lines will not only tend to make of meteorology an exact science, but will also enable us to practically construct quite accurate daily weather maps at moderate elevations, that is, up to 1 and 2 miles above the surface. Such an outcome would amply repay the expenditure of much time and labor in the preliminary steps required to reach this goal; yet it is thought that the results contained in this report are such as to warrant the entering upon their actual application at once, with the expectation that further experience will merely improve upon the close approximations already secured."

The author believes that increased equipment for observations of this character, including a permanent station for theodolite observations at Washington, D. C., and the equipment of each of the first-order stations of the Weather Bureau with a nephoscope will furnish the basis for a more accurate system of weather forecasting. To this end he recommends especially that the data collected be used in the construction of auxiliary maps showing the atmospheric motions at elevations of 3,500 and 10,000 ft.

Amount of chlorin in rain water collected at Cirencester, E. KINCH (*Jour. Chem. Soc. [London], 77 (1900), No. 457, pp. 1271–1273*).—The total rainfall, and its content of chlorin, is given for each six months (October to March and April to September) from October 1, 1886, to September 30, 1900, together with averages for the winter and summer periods and for 14 and 26 years. The averages are as follows:

Rainfall and chlorin content of rain water at Cirencester, England.

	Rainfall, inches.	Chlorin, in parts per million.	Equivalent to NaCl, grains per gallon.	Equivalent to NaCl, lbs. per acre.
Mean of 14 winter periods to March, 1900	14.26	3.55	0.412	19.35
Mean of 14 summer periods to September, 1900	12.78	2.27	.261	10.40
Yearly average of 14 years to September, 1900	27.04	2.91	.337	29.75
Mean of 26 winter periods to March, 1900	15.83	3.76	.435	21.29
Mean of 26 summer periods to September, 1900	14.78	2.58	.302	14.81
Yearly average of 26 years, October 1, 1874, to September 30, 1900	30.61	3.17	.369	36.10

"It will be seen that the total deposit of chlorids is distinctly greater in the winter months than in the summer months, this being largely dependent on the prevalence of S. W. gales from the Bristol Channel. . . .

"Taking all the chlorids as being in the form of sodium chlorid, the yearly average deposit of common salt per acre for the past 26 years has been 36 lbs., and for the past 14 years it has been nearly 30 lbs."

Rain, river, and evaporation observations in New South Wales, 1898, H. C. Russell (*Dept. Public Ins., Met. New South Wales. Results of rain, river, and evaporation observations made in New South Wales during 1898. Sidney: Government, 1900, pp. 55+235, dgms. 7*).—Rainfall and river observations at 1,581 stations, 1,517 of which are voluntary, are reported in detail. Readings of tide gages at 3 places are also reported. The average rainfall for the Colony during 1898 was 20.54 in., as against an average for 28 years of 24.85 in., being the fourth successive drought year. The rainfall increases notably with the location and elevation, the highest average rainfall recorded, 64 in., occurring just at the foot of a range of mountains 4,000 to 6,000 ft. high, against which the trade winds blow. Observations on evaporation from water surfaces at 10 places and also on wind movement at some of these places are recorded. The evaporators used are thus described:

"The vessels used are tanks 4 ft. in diameter and 3 ft. deep set into the ground 2 ft. 11 in., leaving 1 in. above the ground to prevent surface water running in. The float is of glass, and has a light brass tube extending upward through two guide holes. Above it is a screw gage so constructed that contact can be made with the top of the float rod, and the exact height of it to one-thousandth of an inch read off without a vernier. This is effected by having ten threads to the inch in the screw and the head working on it divided into 100, and therefore showing thousandths of an inch."

The total evaporation recorded during 1898 varied from 33.993 to 82.933 in. The mean temperature of the Colony for 1898 was 62.6° F. As regards long-range forecasts in New South Wales, the author states:

"I am fully convinced that a complete record of the rainfall will enable us to forecast the seasons with some show of success, provided, of course, that the extended knowledge of our rainfall is concurrent with a careful study of Australian and tropical weather, which is now in progress. . . . Further study will, there is reason to expect, explain the reason for dry years and when to expect them."

On the importance of aqueous vapor and carbon dioxid in their relation to absorption by the atmosphere, K. Angström (*Ann. Phys., 4. ser., 3 (1900), No. 12,*

pp. 720-732, figs. 4).—This is an account of apparatus used and results obtained in investigations similar to those recently reported by Very (E. S. R., 12, p. 723). Special attention is given to absorption by carbon dioxid. It was found that in no case did the absorption of terrestrial radiation by carbon dioxid exceed 15 per cent, and the amount of absorption varied very little with fluctuations in the carbon dioxid content, provided this was not less than 20 per cent. The principal result of a decrease of the carbon dioxid content is a somewhat wider diffusion of the radiated heat.

Climatological atlas of the Russian Empire (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 28 (1900), No. 8, p. 343*).—"As a memorial volume commemorating the fiftieth anniversary of the foundation of the Central Physical Observatory founded by the Emperor Nicholas I on April 1, 1849, the present director-general, M. Rykatcheff, has published a magnificent folio atlas, in which, by means of 89 meteorological charts and 15 graphical tables, he has presented the prominent features of the climate of the Russian Empire from Warsaw, on the extreme west, to Bering Strait, on the east, and from Teheran, on the south, to the Arctic Ocean, on the north."

British rainfall for 1899, H. S. Wallis (*On the distribution of rain over the British Isles during the year 1899. London: Edward Stanford, 1900, pp. 307, pl. 1, charts 4*).—This, the fortieth volume of Symons's British Rainfall, gives a brief account of the life and work of G. J. Symons, the founder of the British rainfall service, who died March 10, 1900, and records data on rainfall collected by 3,500 observers. Besides the usual detailed records of the results of the year's observations, the volume contains a discussion of the average rainfall of the decade 1890–1899, as shown by observations at a hundred stations well distributed over England, Scotland, and Ireland.

Summary of weather at the North Louisiana Experiment Station during 1892–1899, J. G. Lee (*Louisiana Stas. Bul. 62, 2. ser., pp. 473–477*).—A monthly summary for each year of observations on temperature and precipitation.

Meteorological summary for 1899 (*Maryland Sta. Rpt. 1900, p. IX*).—A tabular monthly summary of observations at College Park, Md., on temperature and precipitation. The mean temperature for the year was 54° F.; the highest, 98°, June 7, the lowest, 4°, February 9. The total precipitation for the year was 45.8 in.

WATER—SOILS.

Principles of water analysis as applied to New Mexico waters, A. Goss (*New Mexico Bul. 34, pp. 55–106*).—This bulletin reports and discusses the results of analysis (sanitary and mineral) of 148 samples of stream, spring, and well waters examined in the laboratory of the station during the past 8 years. Analyses of 14 samples from sources outside of New Mexico are given for purposes of comparison. The bulletin includes the results of a continuation during 1899, in cooperation with this Office, of a study of the fertilizing value of the matter carried by the Rio Grande water, commenced in 1893 (E. S. R., 5, p. 1002), and of similar studies of the water of the Pecos River and other streams used for irrigation purposes in New Mexico.

"The total solids in the Pecos water are much higher than in the Rio Grande water, averaging in the 6 regular samples analyzed 314.20 parts as compared with 44.11 for the Rio Grande during 1893–94.[1] The alkali is also correspondingly higher in the

[1] The 3 samples of Rio Grande water analyzed in 1899 were from the small streams which came down the river after periods of complete dryness, and were therefore abnormally charged with alkali.

Pecos, averaging 157.38 parts as compared with 22.09 parts for the Rio Grande. The alkali in the Pecos water, like that in the Rio Grande, is all of the white variety. It is present, however, in such large amount that it would be very liable to cause trouble in a few years unless provision were made for draining the land and washing it out, or otherwise disposing of it.

"The sediment in the Pecos water is much less than in the Rio Grande, averaging but 179.6 parts in the former against 831.4 parts in the Rio Grande water even as taken from the ditch. This has a twofold bearing. In the first place, it is a disadvantage from the standpoint of plant food. On the other hand, it is an advantage from the standpoint of reservoir construction, as Pecos reservoirs should not fill up nearly so fast as Rio Grande reservoirs."

The practicability of pumping water for irrigation in the Rio Grande Valley is discussed. Nearly all the waters of this valley contain a large amount of lime. Water suitable for irrigation can generally be found, although the water is of better quality in the valley proper than at the edges of the same, where it is likely to be more highly charged with alkali.

"In the vicinity of Roswell, artesian water is found at a depth of from 200 to 300 ft. The water of these wells, so far as analyzed, runs from 88 to 121 parts total solids. This, while not so good as the water of the Rio Grande for irrigation, is very much better than the water of the Pecos, and when used with judgment should be safe, as the alkali present is all of the white variety. The considerable amounts of lime and magnesia present make the water very hard, and for laundry purposes it would give very much better results after being broken with soda."

The purification of water, especially the removal of lime and magnesia, K. SCHIERHOLZ (*Oesterr. Chem. Ztg., 3 (1900), No. 22, pp. 537–544*).—Tests of the methods of adding lime and soda to correct hardness are reported. The addition of a slight excess of lime in the cold was effective not only in removing the lime and carbon dioxid, but also the magnesia except a trace. Soda removed both the free and combined lime, but was without influence on the magnesia. Methods of correcting hardness in waters containing sulphates of calcium and magnesium in addition to carbonates were also tested. The results indicate that such waters may be softened without the use of soda by adding lime to remove magnesia and carbon dioxid, barium oxid to remove sulphuric acid, and carbon dioxid or oxalic acid to remove the remaining free lime.

Water supply and sewerage (*Massachusetts State Bd. Health Rpt. 1900, pp. 1–574*).—This is a report to the legislature under provision of State laws, and includes advice to cities and towns regarding water supply, sewerage and sewage disposal, pollution of ponds and streams, ice supplies, and rules and regulations for sanitary protection of water supply; examination of water supplies; examination of rivers; summary of water supply statistics; experiments on the purification of sewage and water at the Lawrence experiment station in 1895, including report on tests of methods of sewage purification and filtration of water, the occurrence of iron in ground waters, and experiments on methods of removal (by H. W. Clark); and a report on

sewage purification of cities and towns in Massachusetts. The results of chemical and microscopical examinations of 212 different sources of water supply in use in various cities and towns of the State are given in this report. The experiments on the purification of sewage were devoted mainly to tests of rapid methods, especially the method of subjecting the sewage to decomposition and purification in a tank before applying it to a filter. The usual tables of water supply statistics are given, showing the number of towns supplied with water, the quantity of water used, and a summary of the records of rainfall and flow of streams.

Nitrification and catch crops, P. BONÂME (*Rap. An. Sta. Agron. [Mauritius], 1898–99, pp. 83–94*).—Experiments in continuation of those of previous years (E. S. R., 9, p. 731) are reported. The following table gives the principal results obtained in a study of the progress of nitrification in a normal soil with or without the addition of nitrogenous fertilizers and lime (calcareous sand):

Amounts of nitric nitrogen per 100 gm. of dry soil.

	January 21.	February 12.	March 4.	May 20.	June 20.
Sulphate of ammonia (0.17 per cent nitrogen):	*Mg.*	*Mg.*	*Mg.*	*Mg.*	*Mg.*
Ordinary soil	7	17	27	34	41
Soil with 5 per cent of lime	8	46	66	120	140
Dried blood (0.17 per cent nitrogen):					
Ordinary soil	18	37	50	69	91
Soil with 5 per cent of lime	21	102	131	126	140
Fertilizer (0.17 per cent nitrogen):					
Ordinary soil	31	85	94	94	120
Soil with 5 per cent of lime	41	67	73	94	113
Normal soil without addition of any kind (0.3 per cent nitrogen)	6	6.8	6.8	7	11

Experiments with calcareous sand of 3 grades of fineness indicate that up to 2 mm. in diameter the size of the grains is without effect on the rate of nitrification. Lime applied at one-fifth the rate of the sand was slightly more effective in promoting nitrification, Thomas slag standing next to the sand in this respect, and sulphate of potash third. Gypsum was practically without effect.

The rate of nitrification of some slowly nitrifying materials was tested with the following results:

Amounts of nitrogen per 100 gm. of dry soil.

	March 14.	April 17.	May 25.
Pea leaves:	*Mg.*	*Mg.*	*Mg.*
Without lime	11	22	24
With lime	20	37	43
Compost of cane leaves:			
Without lime	8	14	19
With lime	8	18	19
Manure compost:			
Without lime	10	16	24
With lime	11	19	25
Ordinary soil:			
Without lime	4	9	11
With lime	4	11	11

New researches into Pouillet's phenomenon (the heat developed in wetting powders), T. MARTINI (*Atti. R. Inst. Veneto, 59, pt. 2, p. 615; abs. in Phil. Mag. and Jour. Sci., 5. ser., 50 (1900), No. 307, pp. 618, 619*).—Investigations are reported which show that there are certain substances, such as finely ground thermometer-glass, quartz, calcium carbonate, etc., which moisten well with water or other liquids, but which produce little or no heat under such treatment, while other substances, like powdered silica, the silicates, "vegetable earth," and "artificial coal," show decided rise in temperature when moistened with water, alcohol, ether, etc., the rise in temperature being greater the drier the powder. By carefully drying the materials the author obtained much higher figures for rise in temperature in silica and animal charcoal than were reported in a previous paper.[1] In the author's opinion the development of heat "is produced by the modification that the liquid undergoes when absorbed by the powder, by means of which modification the liquid is reduced to a condition of lower molecular energy." The experiments recorded are thus a contribution to the new theory of solid solutions. An application of this property of finely ground substances (*Benetzungswärme*) to the examination of soils has been noted (E. S. R., 11, p. 1022).

Recent observations on the diluvial formation in the Netherlands with special reference to charting, II, H. VAN CAPPELLE (*Medcd. Geol. Netherlands, Commissie Geol. Onderzoek, 1900, No. 27, pp. 25, figs. 3, chart 1*).—In this, the author's second paper on the subject, he discusses briefly the position of the moraine covering, of the sand, and of the loess formation in the Veluwe plateau in Gelderland. The moraine caps are infrequent and are sometimes covered with sand or gravel. Both the sand and gravel are of preglacial origin, and have evidently been washed down from the hills, of which there are many in this region.

The loess covers the tops of the hills, being thickest in the highest parts, and gradually mixed more with sand in the lower parts. This formation is extremely fertile and is known as the beechland because of the great development of beech trees on this soil. A stratified structure is apparent only when finer or coarser gravel has been mixed with the clay. The loess is closely related to the German Rhine-loess, and was laid down by the Rhine and the Yssel long before these streams had cut out their beds to the present level.

The author concludes that this deposit took place during the time that the second ice sheet approached the borders of the Netherlands and when also the Swiss glaciers spread far beyond their present boundaries.

There are two appendixes, in the first of which the physical structure of the Netherland loess is compared with other similar formations.

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[1] Phil. Mag. and Jour. Sci., 5. ser., 1899, No. 286, pp. 329, 330.

The author finds that in Gelderland, where the loess rests on preglacial sand and gravel, the loess contains a much larger amount of coarse sand than where it rests on a chalk formation, as in Limburg. In the second appendix are given the results of chemical analyses of 2 samples of loess.

The author gives a chart showing the location of the moraine caps in a portion of the Veluwe plateau.—H. M. PIETERS.

On the causes of the treeless conditions of the steppes, S. KRAVKOV (*Selsk. Khoz. i Lyesov., 196 (1900), Jan., pp. 1-13*).—This article is essentially a criticism of the views of G. Tanfilyev relating to the causes of the treeless condition of the steppes, which are advocated by such authorities as A. N. Beketov and V. V. Dokouchayev. The résumé given of the views of Tanfilyev is as follows:

The geobotanical investigations of Tanfilyev have led him to the conclusion that chernozem (black earth) everywhere lies on rocks rich in lime and must be considered, from the nature of its vegetation, as belonging to the calcareous soils. The presence of lime in considerable quantity, as well as of an excess of common salt, is accompanied by the development of a peculiar vegetation. The difference in the vegetation of calcareous and noncalcareous soils can not be explained by the relation of these soils to humidity; nor are the heat properties of the soils of essential importance in this regard. Consequently the action of lime on the distribution of plants is chiefly chemical or due to its solubility in water. Tanfilyev concludes that the cause of the treeless condition of the steppes must be looked for in the character of the chemical composition of the chernozem. The fact that the latter lies everywhere on rocks rich in soluble salts, and especially in calcium carbonate, leads to the view that the treeless condition of the steppes is closely connected with the abundance of these salts in the soils of the steppes. Hence it follows that forests will be established only in localities where the conditions favor leaching of the soils, *i. e.*, on the slopes of ravines and on divides. In invading the steppes the forests descend from the divides along the declivities, advancing as the reduction of the soluble salts proceeds. Taking into consideration that chernozem lies everywhere on rocks rich in lime, and that the forest collects and holds the moisture which permeates the soil under it to a great depth, the author further infers that the forest soils must be leached out to a greater depth than those of the steppes. As an index of the degree to which this leaching has proceeded he selects calcium carbonate, which is always a constituent of the normal chernozem soils and subsoils and whose presence is easily detected by the addition of an acid. By the aid of the "method of effervescence" forest soils can be distinguished from those of the steppes.—P. FIREMAN.

FERTILIZERS.

The influence of the distribution of fertilizers on their action, J. M. POMORSKI (*Ztschr. Landw. Versuchsw. Oesterr., 3 (1900), No. 7, pp. 649–684, pls. 3*).—Field and pot experiments with oats, barley, and celery are reported in which fertilizers (superphosphate, Thomas slag, nitrate of soda, sulphate of ammonia, and kainit) were applied (1) as top dressing, (2) in furrows and rows, (3) mixed with the whole of the surface soil, and (4) at different depths in the soil. The results show that the yield was influenced not only by the kind and amount but also by the distribution of fertilizers. The influence varies with the kind of plant and fertilizer and depends upon the character of the root system, the special fertilizer requirements of the plant, and the manner in which it takes up its food. It is therefore of great practical importance not only to determine the relative effectiveness of the different fertilizers for each soil, but also the method of application which will give the best results, taking into account at the same time the influence of supplementary fertilizers in modifying the action of the principal fertilizing ingredients required by the soil. It was found, for instance, in the experiments reported, that superphosphate in small amounts in the upper layers of the soil interfered with the action of nitrogen in sulphate of ammonia. In other words, the action of sulphate of ammonia was dependent upon the distribution of the other fertilizer in the soil. All fertilizers gave better results when mixed with the soil than when applied in layers.

Field experiments with phosphoric acid in various forms, F. W. DAFERT and O. REITMAIR (*Felddüngungsversuche über die Wirkung der Phosphorsäure in verschiedenen Formen. Vienna: Landwirthschaftlich-chemischen Versuchsstation, 1900, pp. 23*).—Field experiments with different samples of Thomas slag, superphosphate, Algerian phosphate, and degelatinized bone meal are reported. The phosphoric acid of Thomas slag, having a high citrate solubility, was no more effective on either summer or winter grain than that of slag having a low citrate solubility, the value of the slag being determined by its total phosphoric acid content. The purchase of slag on its citrate-solubility is condemned on both scientific and practical grounds. The degelatinized bone meal gave good results with summer grain. The author therefore concludes that the results of pot experiments which indicate that the phosporic acid of bone meal is of no value are unreliable. Algerian phosphate appeared to be of equal value with Thomas slag for summer grain. The relative effectiveness of the phosphoric acid in Thomas slag and in superphosphate was as 70 to 100 in experiments with oats and barley. The effectiveness of the phosphoric acid in Algerian phosphate and bone meal was very nearly the same as that of the phosphoric acid of Thomas slag. The relative

value of the phosphoric acid in the various phosphates is calculated in this article from the increase in yield of grain. The author considers calculations based upon the recovery of the phosphoric acid in the crop to be entirely unreliable.

The action of burnt lime and marl on light sandy upland soils, NEUBERTH (*Deut. Landw. Presse, 27 (1900), No. 79, p. 983*).—These substances were compared on peas in 1896 on inoculated and uninoculated soils. The burnt lime did not interfere with the action of the inoculating soil. The yield was larger when lime was used in connection with inoculating soil than when marl was so used. When the lime and marl were used alone the yield was decidedly less with the former than with the latter, due especially, it is claimed, to the action of the lime in decomposing the organic nitrogenous matter of the soil and thus causing its loss by leaching, and also to volatilization of ammonia by the action of the lime. The nitrogen content of the crop grown with lime was much smaller than that of the crop grown with marl. The peas were followed by buckwheat in 1897 and rye in 1898 and 1899. No further applications of lime were made, but all plats received like amounts of stable manure each year. The effects of the liming were very marked on the last crop of rye. The crop was poorest on the unlimed soil and best on that which had received marl.

The results, it is stated, indicate the need of lime in such soil as that used in this test, but show that large applications of caustic lime may prove injurious. Marl seems to be better suited to soils of this character.

Analyses and valuations of fertilizers, L. A. VOORHEES and J. P. STREET (*New Jersey Stas. Bul. 145, pp. 52*).—This bulletin reports on the trade values of fertilizing constituents in 1900 and the results of examinations of the standard materials supplying them, as well as of home-mixed and factory-mixed fertilizers and miscellaneous fertilizing materials. The cost, valuation, and purchase of fertilizers, guaranteed and actual composition, and home mixtures and special fertilizers are discussed. Analyses and valuations are given of 47 samples of standard raw materials, 300 brands of complete fertilizers, 17 samples of home and special mixtures, 25 samples of ground bone and 31 samples of miscellaneous products. Materials examined included, in addition to the mixed fertilizers, nitrate of soda, sulphate of ammonia, dried blood, ammonite, dry ground fish, superphosphate, muriate of potash, sulphate of potash, kainit, wood ashes, licorice root ashes, land plaster, salt, marl, and muck. About 87 per cent of the brands of fertilizers examined contained as much total plant food as was claimed, but in only 71 per cent was the plant food distributed in the proportions stated. The averages for all brands of complete fertilizers examined during 1900 are as follows: Total nitrogen 2.41 per cent, total phosphoric acid 11.03 per cent (available phosphoric acid

8.44, insoluble 2.59), potash 5.89 per cent; station valuation $20.77, selling price $27.26.

From the data obtained "it appears that the manufacturers are delivering on the average practically the same amounts of total plant food as in 1899, in slightly different proportions, but at an average price per ton that is 49 cts. lower, notwithstanding the increase in the wholesale prices of ammoniates." The tendency noted in previous reports toward furnishing less nitrogen and more phosphoric acid and potash is still more marked in the average for 1900. The average cost per pound of nitrogen in 5 samples of nitrate of soda examined was 12.94 cts.; of 2 samples of sulphate of ammonia, 15.82 cts.; 3 samples of dried blood and ammonite, 14.17 cts.; 13 samples of ground fish, 13.66 cts. The average cost per pound of available phosphoric acid in 17 samples of superphosphate was 4.09 cts. The average cost per pound of potash in 5 samples of muriate of potash, 4.11 cts.; of 1 sample of sulphate of potash, 4.77 cts.; and 1 sample of kainit, 3.37 cts.

Nitrate of soda and sulphate of ammonia, R. Warington (*Ann. Agron., 26 (1900), No. 11, pp. 530–561*).—This is a translation from the English by E. Demoussy of an article which has already been noted in the Record (E. S. R., 12, p. 529).

Inspection and analyses of fertilizers, W. F. Hand et al. (*Mississippi Sta. Bul. 64, pp. 31*).—This bulletin contains brief statements regarding the collection of samples, the management of the fertilizer control during the season of 1899–1900, explanations of terms used in fertilizer analyses and of the valuation of fertilizers, suggestions regarding the form of certificate to be used on samples sent for examination and of guaranties to be used on packages of fertilizers, and tabulated analyses and valuations of 211 samples of fertilizers examined during the season of 1899–1900.

Another warning in regard to compost peddlers, W. A. Withers (*North Carolina Sta. Bul. 173, pp. 83–90*).—The purpose of this bulletin is to repeat a warning given in an earlier bulletin (E. S. R., 9, p. 123). This warning is emphasized by pointing out the defects in 2 fertilizer formulas which have been offered for sale in North Carolina. The bulletin also contains a list of books and other publications relating to fertilizers which the author recommends to those desiring information on this subject.

FIELD CROPS.

Field experiments, J. G. Lee (*Louisiana Stas. Bul. 62, 2. ser., pp. 453–473*).—Results secured in cultural and variety tests and in rotation experiments are here recorded. An account of the three-course rotation of corn, oats followed by cowpeas, and cotton has been previously noted (E. S. R., 7, p. 398). Data are here given for the crops grown during each of the years 1889 to 1899. A part of the experimental plats has been regularly manured. An examination of the results obtained shows that "the fertilized half has been built up 400 to 500 per cent in 11 years while that without fertilizer has gained from 12 to 25 per cent."

In a test of 27 varieties of cotton, the largest yield of seed cotton was afforded by Hawkins Prolific, closely followed by Texas Bur,

Truitt Improved, Jones Improved, and Hogerman. King was the earliest maturing variety.

Twelve varieties of wheat were grown on (1) deep red sandy soil and (2) light gray sandy soil. The tabulated results show an average yield for the 12 varieties of 22.08 bu. per acre on the red sandy soil and 12.26 bu. per acre on the light gray soil. The variety Eclipse, followed by Tuscan Island and Currell Prolific, gave the best yields on the red lands.

Of 27 varieties of corn tested, Mosby Prolific, Gondy Improved, and Cocke Prolific, with yields of 37, 36.7, and 31.9 bu. per acre, respectively, took the lead in productiveness. Shallow level cultivation gave the best results in culture experiments.

The value of irrigation water in addition to the natural rainfall was tested for sugar cane, corn, cotton, sorghum, tobacco, cowpeas, and watermelons. Equal areas for each crop were selected and ½ of each area irrigated. It was assumed that the soil for sugar cane required for its best growth 25 per cent of moisture, corn 10 to 12 per cent, cotton and cowpeas 6 to 8 per cent, tobacco and sorghum 8 to 10 per cent, and watermelons 4 to 6 per cent. As nearly as possible these percentages of moisture were maintained for each crop by irrigation. The cowpeas did not mature pods in this experiment. The accompanying table shows the results per acre on the irrigated and unirrigated portions of the remaining plats:

Results of irrigation.

	Sugar cane.	Corn.	Sorghum.	Seed cotton.	Cured tobacco.	Water-melons.
	Tons.	*Bushels.*	*Tons.*	*Pounds.*	*Pounds.*	*Pounds.*
Irrigated	11.50	20.85	3.42	1,892	1,204	18,834
Nonirrigated	3.44	10.41	1.98	1,548	751	9,632

The cane grown on the irrigated plat had a higher sugar content and percentage purity than that grown on the unirrigated. During the progress of the experiment it was found that the moisture content of 25 per cent was too high for the sugar cane on red sandy soil and the amount was therefore reduced to 14 to 16 per cent. It is believed that the difference in yields between the irrigated and unirrigated plats, as shown by the table, would have been more strikingly in favor of irrigation had fertilizers been used.

Experiments with bright leaf tobacco consisted of fertilizer and variety tests and a comparison of home-grown with Virginia-grown seed. In the fertilizer test the addition of nitrogen materially increased the yield. Phosphates and potash used either singly or combined gave but slightly increased yield over no manure. Sulphate of ammonia was not as effective as a source of nitrogen as cotton-seed meal, nitrate of soda, or dried blood. Virginia-grown tobacco seed with but 1

exception gave better results with 11 varieties of tobacco than home-grown tobacco seed.

Other data are included on the growth of sugar cane, cowpeas, forage crops, and grasses and clovers.

Results of fertilizer experiments with sulphate of ammonia, KLOEPFER (*Fühling's Landw. Ztg., 49 (1900), Nos. 10, pp. 376–384, figs. 3; 11, pp. 396–406, figs. 3; 12, pp. 436–445, figs. 2*).—The results obtained in fertilizing potatoes, sugar beets, and fodder beets with different amounts of sulphate of ammonia are reported, the data being considered from the standpoints of yield and financial gain. With potatoes the best yields of 4 varieties tested and the largest financial gains were obtained with the variety Prof. Wohltmann, when 200 kg. of sulphate of ammonia was applied per hectare. The yield was at the rate of 26,384 lbs. per acre and gave a net profit of $91.70. In the case of sugar beets, the largest yield of beets and tops was obtained by the application of 400 kg. of ammonium sulphate per hectare, but the greatest amount of sugar was obtained from the plat where only 300 kg. per hectare had been applied.

The varieties Tannenkrüger and Eckendorfer were used in the experiment with fodder beets. The greater yield was afforded by Tannenkrüger when ammonium sulphate was used at the rate of 400 kg. per hectare.

Fertilizer experiments with Thomas slag and nitrate of soda supplementary to barnyard manure, LILIENTHAL (*Fühling's Landw. Ztg., 49 (1900), No. 7, pp. 265–270, fig. 1, plan 1*).—Experiments were made in supplementing liberal applications of barnyard manure for white cabbage, fodder beets, and a species of cabbage-turnip, with applications of 400 and 800 kg. of Thomas slag per hectare, of 200 kg. of nitrate of soda, and of a mixture of 200 kg. of nitrate of soda with 800 kg. of Thomas slag. The experiment was conducted on marsh soil, which proved detrimental to the best working of the nitrate of soda. Both the smaller and the larger applications of Thomas slag alone gave largely increased and financially profitable yields with each of the different crops grown. The use of 800 kg. of Thomas slag and 200 kg. of nitrate of soda, while giving slightly increased yields with fodder beets and cabbage turnips, was accompanied in each instance by financial loss. It is concluded from these experiments that supplementing the phosphoric acid of stable manure with Thomas slag is desirable.

Inoculation of soils, G. W. HERRICK (*Mississippi Sta. Bul. 63, pp. 11, figs. 2*).—In the experiments here recorded hairy vetch (*Vicia villosa*) was sown on 3 contiguous plats of soil at the station supposedly free from root tubercle germs. The first plat was inoculated with soil taken from an old field in which vetch had been previously grown. The inoculated dirt was scattered in the drills after the vetch had been

sown and both covered with soil. The second plat was used as a control. The third was sown with seed which had been treated with a water extract of infected soil. All plats were cultivated alike. Tubercles were especially abundant on the vetch roots in plat 1; they were less abundant on plat 3, and were but feebly developed in the control plat. The yield from the plat inoculated by scattering dry earth in the drills was 79 lbs., from the control plat 49 lbs., and from the plat inoculated with water extract 64.5 lbs.

Some general remarks on methods of inoculating soils, etc., are added.

Researches on the culture of blue lupines, P. P. DEHÉRAIN and E. DEMOUSSY (*Ann. Agron., 26 (1900), No. 4, pp. 169–196, figs. 2*).—Pot and field culture experiments covering 3 years were made with blue lupines. The following are the more important conclusions based on the results obtained: Blue lupines will grow on either acid or alkaline soils. The presence of carbonate of lime in the soil is not an obstacle to their development. They are incapable of utilizing the gaseous nitrogen of the air without exterior aid. Blue lupines, like white lupines, often develop root nodules which are of little value in furnishing nitrogen to the plant. Lupines frequently thrive without there being nodules formed on their roots. Nitrogen in these cases may be furnished by the association of algæ and bacteria, which form organic material that may be directly assimilated by the plant. Neither the bacteria most favorable to the formation of useful root nodules on blue lupines nor the algæ and bacteria favorable to the formation of organic matter which can be taken up by the plants are widespread, a fact which often accounts for the poor growth of blue lupines in certain districts.

Varieties of cotton, E. R. LLOYD (*Mississippi Sta. Bul. 62, pp. 8*).—Twenty-four varieties of cotton were grown in 1899. Detailed data are given regarding the yield, value, and commercial classification of each. The 6 varieties giving the highest total money value per acre were Roby Prolific, Hawkins Jumbo, Smith Improved, Ozier Big Boll, King Improved, and Kemper Co. Cotton.

A summary of the results obtained in variety tests of cotton for each of the years 1889–1899 is included. This summary shows that the foreign varieties of cotton tested at the station have been of minor value. Long staple varieties of cottons when grown on hill lands have made smaller yields and given lower total values per acre than medium or short staple sorts. Varieties grown for a number of years on the northern border of the cotton belt mature earlier than when grown farther south. The yield and the length and value of the staple are greatly increased by the richness of the soil. This is said to be true especially of the long staple varieties. Further work at the station in variety testing is to be discontinued for the present.

Potato improvement and culture, M. FISCHER (*Fühling's Landw. Ztg.*, *49* (*1900*), *Nos. 8, pp. 301-307, figs. 4; 9, pp. 343-352, figs. 6; 10, pp. 369-372*).—Variations in the development of vines and tubers within the same variety, due to the form, size, or starch content of tubers used for mothers, were studied, as was also the ability of potato tubers to inherit and transmit individual characteristics. Similar work by the author has been previously noted (E. S. R., 10, p. 1039).

Tubers weighing between 60 and 70 gm. each were divided into 2 lots, the first of flat round tubers containing between 18.21 and 19.85 per cent of starch, and the other of long round tubers having only 11.83 to 13.79 per cent of starch, and these used for seed. Both the vine development and the yield of flat round potatoes were much less than that of the long round tubers. A comparison of 2 typical potatoes showed that if the yield of vines and tubers from the flat round potatoes be taken as 100, the weight of the vines from the long round tubers would be 142 and the weight of the tubers 216. Further experiments substantiated these results, and showed further that flat round potatoes high in starch content used for mothers produced a much larger proportion of tubers of a flat round form and having a high starch content than were obtained from planting long round potatoes low in starch content.

An explanation is given of the relation between form and starch content of potatoes. The zone richest in starch in potatoes lies next to the outside of the tuber. The inner part of the tuber is much poorer in starch. Other things being equal, the tuber having the greatest outer starch zone in proportion to the inner part or mark of the tuber will be richest in starch. The flat round potato should therefore contain more starch than the oblong form of equal weight, and this hypothesis is substantiated by analytical results. The matter of form is therefore considered of importance in selecting tubers for improvement on the basis of starch content. Considerable data are presented showing the relation of form of seed planted and product yielded.

In a comparison of nitrate of soda and ammonium sulphate, alone and in combination with superphosphate, as a fertilizer for potatoes, the best yields and greatest profits were obtained when the ammonium sulphate was used. Generally superphosphate was used at a loss.

Experiments were made in planting large potatoes, whole and cut in halves, in comparison with small potatoes. Large potatoes in both cases gave an increased yield over planting small tubers. After deducting the cost of the seed, the large potatoes cut in halves resulted in a loss and the large whole potatoes a gain over planting small tubers.

Lime experiments with potatoes on light marsh soil, LILIENTHAL (*Fühling's Landw. Ztg.*, *49* (*1900*), *No. 12, pp. 459-462, fig. 1*).—Two

varieties of potatoes were grown on light marsh soil poor in lime. Four plats were used in each test. Plat 1 was used as a check. The others received marl, loamy marl, and quicklime, respectively. Marl was used at the rate of 112 cwt. per hectare and quicklime at the rate of 54 cwt. per hectare. One of the varieties of potatoes grown, the Hamburger Egg potato, proved too tender for successful growth in the fresh marsh soil, and its culture resulted in decreased yields and financial loss except where ground marl was used. With the other variety of potato, the Bruce, increased yields were obtained with all the different forms of lime, but the greatest net profit with this variety, $68.58 per hectare, was obtained on the plat given the ground marl. A table showing the amount of marl to apply on land when the marl contains different amounts of calcium carbonate is given.

Experiments in the culture of the sugar beet in Nebraska, H. H. NICHOLSON and T. L. LYON (*Nebraska Sta. Bul. 67, pp. 17–21, figs. 2*).—This bulletin summarizes the results secured during the season in cultural, fertilizer, and variety tests with sugar beets. As in previous trials (E. S. R., 11, p. 839), the experiments have been carried out on a large scale on the Standard Cattle Company's beet sugar fields at Ames, in the Platte River Valley.

Heavy clay soils have produced better beets both in years of average and of excessive rainfall than sandy loam soils, though they did not mature so rapidly. In selecting land for sugar beets the authors advise choosing a clay soil. Shallow cultivation 3 to 4 in. deep throughout the season, with the rows 18 in. apart and the plants 8 in. distant in the row, has again given the most satisfactory results. "A plan that gave very satisfactory results was to allow 18 in. between every fourth row and 15 in. between the others. This plan admits of horse cultivation if a four-row seeder and cultivator are used."

The author states that—

"Of the varieties tested during 1898 and 1899, on both heavy and light soil, the best were the original Kleinwanzlebener, Pioneer Kleinwanzlebener, Vilmorin, Drumez Elite, and Knauer. * * * The use of commercial fertilizers and of barnyard manure increased materially the yield per acre, but not the sugar content or purity of the beets. The advantage to be derived from the use of commercial fertilizers is not sufficient to pay for their cost. With barnyard manure, however, the case is entirely different, and its use either for a previous crop or directly for the beet crop is very profitable."

Experiments with wheat, 1900, F. C. BURTIS and J. G. KERR (*Oklahoma Sta. Bul. 47, pp. 26–48*).—Experiments are recorded consisting of early, medium, and late plowing; early, medium, and late seeding; growing wheat continuously on the same soil with and without manure, and tests of varieties.

In the first experiment, ground from which a crop of oats had been harvested was divided and sections plowed July 19, August 15, and September 11, respectively. The section plowed July 19 turned up

moist and mellow; that plowed August 15 turned up more or less dry and lumpy. Both these sections were harrowed at intervals after plowing until seeding time. The section plowed September 11 was weedy. It turned up lumpy, and was dry as far down as the plow ran. Rains which had greatly benefited the earlier plowed section were without measurable effect on this. Repeated disking, harrowing, and rolling was necessary to get it into any kind of shape. It is estimated that about 8 times the labor was put on it that would have been needed had the ground been moist at the time of plowing. All the sections were seeded September 15. The wheat in the earlier plowed section germinated promptly and continued to grow without check. On the late plowed sections many plants perished for want of moisture, and in the summer following the crop matured later, was more seriously affected by blight, and the grain was more shriveled. The yields from the different sections averaged as follows: Early plowed 31.32 bu., medium plowed 23.48 bu., and late plowed 15.3 bu. per acre.

"An important point to consider in connection with late plowing for wheat is the weeds on the ground, that help take its moisture and go to seed, making foul ground for future crops. Where this experiment was situated the soil was unusually free of weed seed, but some were present. On the August plowing the weeds were scattered and a part of them had gone to seed, but many of them were not matured. On the September plowing the weeds had gone to seed, but were not thick on the ground. Preventing weeds going to seed, and ridding the land of others that are started and destroyed by the frequent harrowings on early plowing, will well pay for an extra effort to do early plowing, to say nothing about the increase in yields of wheat that are obtained."

In the experiment to test the relative merits of early, medium, and late seeding, plats were seeded September 15, October 18, and November 15. The yields obtained from the different seedings were as follows: Early seeding 36.8 bu., medium 34.84 bu., and late 23.47 bu. per acre. The grain from the late seeding weighed 7 lbs. less per bushel than from the early or medium seeding. With late seeding, especially on poorly prepared land, about ½ bu. seed per acre more than usual was required. In 6 former trials at this station the November seeding ranged in yields from 1 to 13 bu. per acre, the October seeding 4 to 30 bu., and the September seeding 15 to 49 bu.

Wheat has been grown continuously since 1892 on the same ground without manure. In 1898 one-half of the land was manured with barnyard manure at the rate of 15 tons per acre. The results obtained for the 2 seasons 1898–99 and 1899–1900 show yields of 30.6 and 36.8 bu. per acre, respectively, on the manured part, and 12 and 18.1 bu. per acre, respectively, on the unmanured.

Of 17 varieties of wheat grown in 1900 Sibley New Golden gave the largest yield, 44.5 bu., and Big English the smallest, 37.7 bu. per acre. The following varieties, most of which have been grown at the station for 6 years, are recommended: *Soft smooth wheats.*—Early Red

Clawson, Fultz, German Emperor. *Soft bearded wheats.*—Fulcaster, Missouri Blue Stem, New Red Wonder. *Hard smooth wheats.*—Red Russian, Oregon Red. *Hard bearded wheats.*—Sibley New Golden, Turkey Eversaw.

The moisture content of the plats plowed on different dates in these experiments was determined at various times from July 19 to May 14 following, and a record kept of the rainfall. On August 7 the plowed land had 5 per cent more moisture than the unplowed; on the 30th, the difference was 10.3 per cent. The moisture content of the unplowed land at this time was between 8 and 9 per cent, and the soil was too dry to plow readily. "September 11, three days before the date of seeding, the early plowed ground contained 16.8 per cent of moisture, the medium plowed 13.9, and the late plowed only 7.7 per cent—4.3 per cent less than the amount required to germinate wheat readily, while the early plowed contained 4.8 more than the required amount." Manured land did not seem to retain any more moisture in these experiments than unmanured.

Field experiments with wheat, J. F. HICKMAN (*Ohio Sta. Bul. 118, pp. 213–238*).—The variety and cultural experiments with wheat begun by the station in 1893 and reported on up to 1897 (E. S. R., 9, p. 1046) have been continued and are here reported in detail for 1899 and averaged for the whole period. At the station farm Poole, Mealy, Red Russian, and Early Ripe of the smooth varieties, and Nigger, Currell Prolific, Gypsy, and Egyptian of the bearded varieties have given the highest yields. The variety Valley seems especially adapted to rich alluvial soils. For upland soils Poole, Mealy, Red Russian, Nigger, and Improved Poole are recommended. "In a single experiment conducted on good clay land in Cayuhoga County, the Velvet Chaff wheat gave better results than any other of the 10 under test."

So far as the station's observations have gone, no variety of wheat has been found fly proof, but Mealy, Mediterranean, Fulcaster, and Clawson are among the sorts considered most resistant to the Hessian fly. Replies to a circular of inquiry regarding the resistance of the Mealy variety of wheat to the Hessian fly are included in the bulletin.

The range in date of ripening of the different varieties of wheat tested has rarely exceeded 12 days. The conclusions reaching regarding the various cultural features under test are as follows:

"Higher average yields have been produced where the quantity of seed used reached 9 and 10 pk. per acre on moderately productive clay soil.

"Wheat grown upon ground sufficiently seeded to produce the highest yield per acre has given highest average weight per measured bushel. The lightest weight wheat has been grown where land was seeded more lightly.

"Better results have been secured by seeding in this latitude from the 12th to the 20th of September than by earlier or later seeding.

"Wheat one year old, if it has been kept in a suitable place and is of fair quality, will likely be as good to use for seed as new wheat.

"Spring wheat, with present condition of Ohio soils and climate, is not likely to prove successful. After repeated trials on rich, alluvial land and upon the thinner clay land our experiments have proved failures, both in quantity and quality of wheat produced."

Report of the agriculturist, E. R. Lloyd (*Mississippi Sta. Rpt. 1900, pp. 15–19*).—A report of variety tests with cotton (see p. 844) and wheat, fertilizer experiments with cowpeas, and culture experiments with sorghum, cowpeas, and corn. Sorghum drilled alone and cut after the heads had nearly ripened yielded 10,333 lbs. of cured hay per acre. When drilled with cowpeas the total yield of cured hay was 7,250 lbs. per acre. Sown broadcast together the yield was 8,207 lbs. per acre. The greatest yield of grain was obtained when corn was allowed to ripen on the standing stalk.

Report of the assistant agriculturist, R. S. Shaw (*Montana Sta. Bul. 24, pp. 145–150*).—Outline of the work of the year with the tabulated yields, etc., of 66 varieties of wheat, 44 of oats, and 21 of barley.

Report on farm work at the Momohaki, New Zealand, Experiment Station, F. Gillanders (*New Zealand Dept. Agr. Rpt. 1900, pp. 231–247*).—This report briefly describes the manner of carrying on the work and gives the results obtained in tabular form. The experiments comprise variety tests with cereals, grasses, potatoes, and root crops, and a fertilizer test on mangel-wurzels.

Deep-rooted plants for green manuring (*Hessische Landw. Ztschr., 70 (1900), No. 48, pp. 664, 665*).—A popular article referring to results obtained by different investigators of the subject.

Fenugreek (Trigonella phœnum græcum) as a soil improver, G. D'Ancona (*Staz. Sper. Agr. Ital., 33 (1900), No. 4, pp. 357–364*).

Grasses for permanent meadows on marshy soils, C. Nissen (*Landw. Wchnbl. Schleswig-Holstein, 50 (1900), No. 48, p. 827*).—Brief notes on a number of desirable and undesirable grasses for this purpose.

Grasses for pastures and meadows, Tancré (*Landw. Wchnbl. Schleswig-Holstein, 50 (1900), No. 51, pp. 869–872*).—The value of different grasses for these purposes is discussed and various grass mixtures suggested.

Historical notes on hop culture in the Altmark, Bruhne (*Landw. Wchnschr. Prov. Sachsen, 2 (1900), No. 45, pp. 411, 412*).—Popular historical notes on hop culture in the region of the Province of Saxony known as the Altmark.

Experiments with potatoes, A. Jäger (*Deut. Landw. Presse, 27 (1900), No. 96, pp. 1155, 1156*).—Results of variety tests for the years 1898 to 1900.

Potash for potatoes (*Agr. Jour. Cape Good Hope, 17 (1900), No. 11, p. 665*).—A popular article on the need of potash in the soil for the successful growth of the potato.

Special potato trials (*New Zealand Dept. Agr. Rpt. 1900, pp. 255–263*).—A report on a test of 111 varieties of potatoes grown at Waihao and Wyndham. The results are given in tabular form. Among the best yielding varieties were Dalmahoy, White Rock, Carter Abundance, and Durwent, with yields of over 11, 10, 9, and 8 tons per acre, respectively.

Does nitrogenous manuring of sugar seed beets have an injurious effect on the succeeding progeny? H. Wilfarth (*Bl. Zuckerrübenbau, 7 (1900), No. 7, pp. 105–110*).—A review of the literature on this subject does not show that this common practice is harmful.

The recent practice of disregarding the established laws in sugar-beet culture and its injurious effects (*Bl. Zuckerrübenbau, 7 (1900), No. 23, pp. 362–367*).—This article is an extract from a lecture on the subject and treats of the manner and time of plowing for sugar beets, the distance at which the beets should be planted, and when and how the thinning should be done.

The daily root work of sugar cane (*Rev. Agr. Réunion, 6 (1900), No. 10, pp. 431–440*).—The discussion of the subject in this article is based on the results of an investigation of the composition of sugar cane by J. D. Kobus, Director of the West Java Experiment Station.

Tobacco culture and industry, E. BOUANT (*Culture et industrie du tabac. Paris: J. B. Baillàire & Son, pp. XII+347, figs. 104*).—The culture, technology, economic importance to the State, and the use of tobacco from a hygienic standpoint are considered in this work. Under culture, chapters are given on statistics, soils and manures, harvesting, and enemies of tobacco; and under technology, chapters on the manufacture of cigars, snuff, chewing tobacco, and secondary products.

Report of wheat raisers, J. FIELDS (*Oklahoma Sta. Bul. 47, pp. 3–25*).—Letters of inquiry requesting information regarding wheat farming were sent out by the station to farmers in the Territory, to which 118 replies, representing 18 counties, were received. These are summarized. They indicate that the soil for wheat in Oklahoma should be plowed early and deep and well worked before seeding. The seeding should be complete before October 15. Pasturing vigorously growing wheat in the fall has been found profitable by many farmers. Grading up seed wheat by the use of a fanning mill is regarded as profitable. Losses from insect ravages have been slight, but rust has frequently affected late wheat. "Hard wheats as a rule are preferred in the western counties and on the uplands. Soft wheats are grown in the eastern counties. Rotation is generally preferred to continuous culture for wheat, and the beneficial effect of manure is mentioned in many cases."

Culture experiments with different square-head varieties of wheat, EDLER (*Landw. Ztschr. Rheinprovinz, 1 (1900), No. 24, pp. 277–279*).—A brief review of the different experiments in this line from 1895 to 1899, inclusive.

The value of varieties of grain with a low stooling quality for breeding purposes (*Deut. Landw. Presse, 27 (1900), No. 101, p. 1207*).—A discussion of results obtained by Schribaux.

HORTICULTURE.

Cabbage—fertilizers, varieties, shipping; cauliflower—varieties and shipping, B. C. PITTUCK and S. A. McHENRY (*Texas Sta. Bul. 57, pp. 24, figs. 14*).—General directions are given for growing and marketing cabbage and cauliflower, including a financial statement of the sale of a carload of cabbage shipped by the station to Kansas City, and an estimate of the cost of growing an acre of cabbage. This is placed at $12.85. Resin-lime mixture has been one of the most effective remedies used against the cabbage worm, and seemed to drive the harlequin bugs away from the plants for a few days. The hot blast blow torch was used successfully for killing both bugs and worms.

In the variety tests with cabbage, Stein Early Flat Dutch gave the largest yield per acre, 28,984 lbs., followed by Autumn King and Frotscher Superior Large Late Flat Dutch, with a yield of 25,935 and 25,810 lbs. per acre, respectively. The experience of the station, coupled with previous observations, show that Danish Ball Head will not withstand a greater degree of cold when the plants are young than the average variety. If the heads are two-thirds grown they stand more cold than any other variety tested. "For extreme hardiness in all stages of growth Frotscher Superior Large Late Flat Dutch has proven better than any other variety."

The coldest weather at the station generally comes between February 15–25. By planting early maturing varieties about August 1 and forcing growth by the liberal use of fertilizers, it is thought the crop may be matured before the February freeze occurs. The 2 varieties, Early Jersey Wakefield and Frotscher Superior Large Late Flat Dutch, were used in testing the relative merits of commercial fertilizers, barnyard manures, and ashes for cabbage. The effects of the barnyard manure were noticed about 2 weeks after it had been applied, while the commercial fertilizers produced no noticeable effect on the growth of the plants until about 6 weeks after the date of application. With the fertilizers and combinations used with both varieties of cabbage, the best and cheapest yields were obtained from the plat fertilized with stable manure at the rate of 20,000 lbs. per acre.

The experiment in growing cauliflower was practically a failure, owing to the damage to the crop by cold and the failure to apply manures. This crop is considered, however, a profitable one to grow, but heavy manuring, as with cabbage, is considered essential to success. The methods of culture employed and the results obtained in a test of 5 varieties are recorded. "Early Snowball proved to be the surest header and earliest variety in the test." Late Italian Giant was a good variety.

The use of chemical manures on garden vegetables, G. Truffaut and Denaiffe (*Jour. Soc. Nat. Hort. France, 4. ser., 1 (1900), Dec., pp. 868–877*).—The authors conducted experiments with fertilizers on vegetables, using theoretical formulas based on the analyses of the vegetables. Preliminary to the experimental work, a large number of vegetables were grown and analyzed when they had reached their maximum development, and a part of these data are reported. Tests were conducted in 1898 and 1899, different vegetables being fertilized with large amounts of fertilizers compounded as noted above. The soil used was rich in organic nitrogen and lime, but relatively poor in potash and phosphoric acid. Based upon the results obtained the authors have prepared the following general fertilizer formulas for different sorts of vegetables:

For beets, cucumbers, carrots, radishes, parsnips, turnips, salsify, potatoes, pumpkins, and squashes, a fertilizer containing 8.3 per cent nitrogen, 11.5 per cent potash, and 14.1 per cent phosphoric acid; for garlic, shallots, onions, leeks, and chives, a fertilizer containing 5.65 per cent nitrogen, 20.1 per cent potash, and 10.35 per cent phosphoric acid; for eggplants, peppers, and tomatoes, a fertilizer containing 7.65 per cent nitrogen, 17.2 per cent potash, and 11.2 per cent phosphoric acid; for cabbage, lettuce, corn salad, sorrel, spinach, artichokes, cardoon, asparagus, celery, and white beets, a fertilizer containing 9.65 per cent nitrogen, 5.95 per cent potash, and 13.45 per cent phosphoric acid; and for strawberries, beans, lentils, and peas, a fertilizer containing 4.05 per cent nitrogen, 8.2 per cent potash, and 17.5 per cent phosphoric acid.

Top-working apple trees, G. H. POWELL (*Delaware Sta. Bul. 48, pp. 16, figs. 12*).—A popular discussion of the methods and advantages of top-working apple trees. Using a hardy, vigorous, straight-growing variety as a stock on which to top-work the permanent orchard, the advantages of the method are summarized as follows:

"It provides a healthy, strong trunk for all varieties, corrects the poor growth of some, overcomes the tenderness of others in the far north, and sometimes makes a stronger system of roots. It gives the grower a chance to select the buds or scions from trees of steady productiveness, hardy foliage, and highly colored fruit. It is said to hasten fruitfulness.

"The stock should be of a vigorous-growing variety as free as possible from body troubles. The Spy makes an ideal stock, and the Ben Davis, Baldwin, Lily of Kent, Tallman Sweet, and Astrachan are in use. Seedling stocks are undesirable, as no 2 of them are alike. . . . Body budding seems to be the most desirable method."

Experiments on the use of nitrate of soda in the culture of grapes, E. MARRE (*Prog. Agr. et Vit. (Éd. L'Est), 21 (1900), No. 50, pp. 716–720*).—Nitrate of soda was used in the culture of a number of varieties of grapes on different soils. The average increase in the yield of the nitrate over control plats was a little more than 23 per cent. The conclusions of the author are practically as follows: Nitrate of soda, whether used alone or combined with barnyard manure or commercial fertilizers, always increased the yield at a profit. Dry weather diminished the beneficial action of nitrate of soda, which was most effective after rains. Applying nitrate at 2 different times and working it into the soil seemed to give the best results. The nitrate was most effective in the presence of phosphatic manures.

Experiments with manures on vines, E. ZACHAREWICZ (*Prog. Agr. et Vit. (Éd. L'Est), 21 (1900), No. 51, pp. 753–760*).—The value of nitrate of soda in addition to phosphoric acid and potash for vines was determined in plat experiments in 3 different localities. The fertilizers were applied between the rows and worked in. The addition of the nitrogen to the phosphoric acid and potash greatly increased the yields in every instance, besides hastening the maturity of the fruit and improving its quality. It is believed that this effect will be best obtained when the potash and phosphoric acid are applied broadcast between the rows in December or January, and the nitrate of soda in March or April, and thoroughly worked into the soil.

The herbaceous vine graft, TRABUT (*Bul. Agr. Algérie et Tunisie, 6 (1900), No. 11, pp. 307, 308, fig. 1*).—Budding in August and the English or Lafleur method of herbaceous grafting are described.

Crossing and hybridizing, F. DORNER (*Amer. Florist, 16 (1900), No. 657, pp. 752, 753*).—Paper read by the author before a late meeting of the Indiana Horticultural Society.

New food yam, Dioscorea fargesii, D. BOIS (*Rev. Hort, 72 (1900), No. 24, pp. 684, 685, fig 1*).—This yam, which has been grown to a limited extent in private gardens, is described. The vine is hardy. The tubers are spherical and rather small,

develop at a shallow depth, are easily harvested and of good quality, though inferior in this latter respect to *Dioscorea batatas.*

The "cheyote," Sechium edule, L. TRABUT (*Bul. Agr. Algérie et Tunisie, 6 (1900), No. 22, pp. 617–622, fig. 1*).—Directions for the culture and uses of the cheyote, or vegetable pear.

Report of the horticulturist, S. M. EMERY (*Montana Sta. Bul. 24, pp. 125–144*).—An outline is given of the work of the year with orchard fruits and strawberries. Lists are given of the apples, pears, crabs, cherries, apricots, prunes, and plums set in the orchard and the number alive after the severe winter of 1898–99.

A test was made of the value of root-pruning two-year-old apple trees according to the Stringfellow method, as compared with those treated normally. Out of 20 trees root-pruned according to the Stringfellow method 12 failed to come out alive in the spring of 1899, while out of 80 unpruned trees only 24 failed to come through the winter. It is stated in this connection that the winter of 1898–99 was the most severe in the history of the station and that of the 20 root-pruned trees only 4 could be classed as especially hardy. The results are considered so favorable that further experiments along this line will be undertaken.

The report on strawberries covers the tabulated data secured in a test with 61 varieties.

The content of plant nutrients in apples and pears, E. HOTTER (*Ztschr. Landw. Versuchsw. Oesterr., 3 (1900), pp. 583–585; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 3 (1900), No. 12, p. 833*).—The average compostion of the ash of 20 varieties of apples and 13 varieties of pears is recorded. The apples were slightly richer in total ash and nitrogen than the pears, but contained only about half as much sulphuric acid. Otherwise the composition of the two was very similar.

Plum in Kansas, with a chapter on prunes (*Topeka: State, 1900, pp. 159*).—This consists of a large number of articles compiled from horticultural journals, bulletins, and reports, by W. H. Barnes for the Kansas State Horticultural Society. The work also contains reports of many Kansas plum growers. The articles selected treat of the botany, pollination, culture, varieties, insects, and diseases of plums, etc. The chapter on prunes is taken largely from California and Oregon sources. It is not expected that prunes can be grown with profit in Kansas, but it is thought that there is a large opening for the plum industry.

California navel lemon (*California Cult., 15 (1900), No. 26, p. 402, fig. 1*).—The origination of an absolute seedless lemon is reported. Illustrations of the new lemon and of cross sections are given.

Olive culture, W. J. ALLEN (*Agr. Gaz. New South Wales, 11 (1900), Nos. 10, pp. 829–836, pls. 5, figs. 5; 11, pp. 1020–1022, figs. 4; 12, pp. 1059–1074, pls. 11, figs. 4*).—Popular article dealing with the history and propagation of olives, soils, transplanting, cultivation, pruning, varieties, oil making, pickling, etc. In the Wagga olive orchard the varieties Bouquettier and Correggiola have been found superior to all other varieties in the production of oil, and these are recommended for planting.

Fruit tree culture in pots, J. HUDSON (*Garden, 58 (1900), No. 1507, pp. 264, 265, figs. 2*).—Fruit houses, potting and pruning trees, and varieties of peaches, plums, cherries, pears, and apples best suited for growing in pots are noted.

Forcing fruits under glass, W. TURNER (*Amer. Gard., 22 (1901), No. 318, p. 58*).—Forcing in borders and in pots is considered and a list given of early, midseason, and late varieties of peaches, nectarines, pears, plums, apples, and figs suitable for the purpose. The temperature at which the house should be held at different periods in the growth of the fruit, methods of watering, pruning, etc., are also considered.

The cocoa tree; its culture and management in all countries of production, H. JUMELLE (*Le cacaoyer; sa culture et son exploitation dans tous les pays de production. Paris: Augustin Challamel, 1900, pp. 211, figs. 19*).—A comprehensive treatise on the

botany, chemistry, commerce, culture, and the insects and diseases of the cocoa tree and its products; and on the countries which produce cocoa. The work is prefaced by a brief historical discussion pertinent to the subject.

The manuring of coffee, A. LEHMAN (*Planting Opinion, 5 (1900), No. 47, pp. 796–799*).—A lecture on the subject, with suggestions regarding experiments.

Coffee, its preparation and effects, GOODFELLOW (*Planting Opinion, 5 (1900), No. 48, pp. 821, 822*).—A popular article, giving statistics on the production and consumption of coffee, and discussing the constituents of the properly prepared article and the methods of its preparation.

Tests of small fruit, J. TROOP (*Indiana Sta. Bul. 83, pp. 107–114*).—Data are here recorded for tests of 82 varieties of strawberries, 32 raspberries, 18 blackberries, and 1 dewberry, in continuation of work previously reported with these fruits (E. S. R., 10, p. 1042). Of the raspberries grown Miller, Cuthbert, Columbian, Golden Queen, Alpha, Conrath, Eureka, Kansas, and Nemaha are recommended for both market and home use. Subsoiling for raspberries is advised. Lucretia is the only dewberry recommended for general cultivation. Of the blackberries grown Agawam, Early King, Erie, Snyder, and Taylor are considered the best for the family garden.

Strawberries, F. S. EARLE (*Alabama College Sta. Bul. 109, pp. 39–51*).—Descriptive notes and cultural data are given on 34 varieties grown at the station, and suggestions given regarding the establishment of a strawberry plantation. Earlier work with strawberries at this station has been recorded in E. S. R., 10, p. 552.

Strawberry culture, E. HECHLER (*Der Erdbeerfreund. Erfurt: J. Frohberger, 1898, pp. 126, figs. 14*).—Practical directions for the culture and rational use of different varieties of strawberries for domestic use and the trade. Some 40 recipes are given for utilizing the fruit.

Resistance of strawberries to frost, E. V. WILCOX (*Montana Sta. Bul. 22, pp. 17–21*).—Preliminary work on this subject has been previously reported (E. S. R., 11, p. 247). In the author's further investigation it has been found that with those varieties of strawberries in which injury from frost was greatest, "the seeds were most exposed or were situated in very shallow depressions of the strawberry pulp. On the other hand, in those varieties which did not suffer from frost, the seeds were protected by being embedded so deeply in pits of the plant that they were practically surrounded by the pulp. Between these 2 extremes there was found a regular series of graduations represented by varieties in which the seeds were embedded in pits in the pulp of varying depth."

Viticulture and wine making in Algeria, J. BERTRAND (*Bul. Agr. Algérie et Tunisie 6 (1900), Nos. 9, pp. 223–253, figs. 6; 10, pp. 265–301, fig. 1*).—A general article covering soils, varieties, manure, culture, diseases, etc., and the manufacture, storage, and commerce of wine. One part is devoted to the phylloxera and the reconstruction of vineyards. The financial aspect is also considered.

Culture of caoutchouc in Brazil, L. FURQUIM D'ALMEIDA (*De l'exploitation du caoutchouc au Brésil. Brussels: Oscar Schepeus & Co., 1900, pp. 24*).—Countries and plants which produce caoutchouc and methods of cultivating, harvesting, extracting, and preparing for market are considered.

Grafting experiments with Malvaceæ, H. LIMLEMUTH (*Gartenflora, 50 (1901), No. 1, pp. 8–11*).—*Malvastrum capense* and *Lavatera arborea* were grafted on *Abutilon thompsoni*. In both instances the scions grew rapidly and bore yellow variegated leaves. Cuttings from the scions were made, some of which the author succeeded in rooting. These also produced the characteristic yellow variegated leaves of *Abutilon thompsoni*.

A new clematis with fragrant flowers, D. BOIS (*Jour. Soc. Nat. Hort. France, 4. ser. (1900), Dec., pp. 865–868, fig. 1.*)—The author describes *Clematis buchaniana*. Both the leaves and flowers of this plant are ornamental and the flowers are very

fragrant. The blooming period begins about September and lasts until freezing weather.

Daffodils, T. BARR (*Jour. Hort.*, *52* (*1900*), *Nos. 2718*, *p. 396; 2719*, *p. 416*).—A historical sketch.

Notes on the honeysuckles, E. A. POPENOE (*Amer. Gard.*, *22* (*1900*), *No. 318*, *p. 57*).—The character and method of propagation and culture of a number of shrub and twining species of Lonicera are reported.

The raising of orchids from seed (*Gard. Chron.*, *3. ser.*, *28* (*1900*), *No. 725*, *pp. 350, 351*).—Details of a successful method of growing orchids from seed.

Methods for growing seed from Phlox divaricata, Daphne cneorum, Toxicophlœa thunbergi, Yucca filamentosa, M. LOBNER (*Gartenflora*, *50* (*1901*), *No. 2*, *pp. 44–48*, *figs. 5*).—The successful methods of the author in fruiting these plants are outlined.

International Congress of Rose Growers (*Jour. Soc. Nat. Hort. France*, *4. ser. 1* (*1900*), *Oct.*, *pp. 693–740*).—In addition to the official proceedings of the society, the text of the following papers, which were read at the meeting of the society in Paris, June 14, 1900, is given: Classification of roses, Virger; Are there races of roses? Viviand-Morel; Hybridity, Allard; The influence of scion on the stock; The different forms of roses and their characteristics, Meyran; Study of the better varieties of China roses adopted by the congress, Meyran.

DISEASES OF PLANTS.

Some field experiments with formalin, M. B. THOMAS (*Proc. Indiana Acad. Sci. 1898*, *pp. 62–64*).—An account is given of field experiments with oats for the prevention of smut by treating the seed with ½ per cent solution of formalin, after which the seed was sown broadcast. Untreated oats were sown at the same time, and so far as early appearances were concerned no difference could be observed as a result of the treatment. The mature plants from the treated seeds were slightly smaller than those from the untreated ones, but the amount of grain produced was the same in both cases. Upon ripening, the plants of the untreated seed showed 6 per cent smutty heads, while there was not a trace of smut to be found on any of the plants grown from the treated seeds.

In experiments with corn in which the grain was soaked in a 1 per cent solution, the seeds were delayed somewhat in their germination, but the early attacks of smut were totally prevented by the treatment. Later infection during the growth of the plant was not prevented by the use of the fungicide.

Seed treatment for the prevention of beet diseases, M. HOFFMANN (*Deut. Landw. Presse*, *27* (*1900*), *No. 66*, *pp. 819, 820*).—An account is given of experiments in which the effect of seed treatment on the germination of seed and the prevention of some of the diseases of beets were investigated. Different lots of beet seed were soaked for 20 hours in a 1 per cent solution of carbolic acid, for 30 minutes in concentrated sulphuric acid, after which they were washed in fresh water and milk of lime; for 20 hours in a 2 per cent solution of lysol,

and for 2 hours in a 1 per cent solution of calcium chlorid. The results of the germination tests of the treated seed are shown, comparisons being made with seed soaked 6 hours in water. With the exception of the seed treated with lysol, the germination of the other lots of treated seed exceeded the check, while the number of diseased plants was less.

A second series of tests is reported, in which the effect of treatment on diseases is shown. Normal seed gave 23.3 per cent of diseased plants, and treated seed gave the following percentages of diseased plants: Soaked in concentrated sulphuric acid, as above, 12.5 per cent; seed removed from seed ball and treated with sulphuric acid, 14.3 per cent; soaked 24 hours in Bordeaux mixture, 20 per cent; shelled and soaked in Bordeaux mixture, 16.6 per cent; soaked for 24 hours in a copper sulphate-soda mixture, 12 per cent; shelled and soaked in a copper-soda mixture, 9.2 per cent; shelled seed untreated, 10.7 per cent diseased.

As a result of his investigations, the author recommends as the best and surest method of treatment the soaking of the seed in sulphuric acid, as described above. The efficiency of the treatments with calcium chlorid, copper-soda mixture, and carbolic acid is in the order named. The last named should not exceed a ½ per cent solution. The experiments in shelling seed showed that the advantage derived from the treatment does not compensate the additional cost.

The rotting of greenhouse lettuce, G. E. Stone and R. E. Smith (*Massachusetts Hatch Sta. Bul. 69, pp. 40, pls. 2, figs. 9, dgms. 7*).—The forcing of lettuce, which has become a very important industry in Massachusetts, is liable to great loss on account of a number of parasitic diseases to which the plants are subject. The authors have been carrying on the investigations for 5 years relative to a cause of these diseases and means for their prevention. Their experiments have at last been brought to such a point of completeness as to warrant publishing the results in detail. The technical portions of their investigations have been already published (E. S. R., 12, p. 764).

As the result of their studies it was found that great confusion has existed as to the cause of a number of diseases of lettuce. The fungus most generally described as causing lettuce diseases is *Botrytis vulgaris*. This fungus is said to occur rather rarely as a parasite on well-grown lettuce. It is commonly associated with the diseases indefinitely known as "damping off," mildew, black root, and rot. The most serious disease of forced lettuce is that called "drop." This disease has been found to be caused by the fungus *Sclerotinia libertiana*, which has not previously been described as occurring on lettuce, but is known to cause similar diseases on a number of other plants. It is a fungus that spreads through the soil and does not yield to the ordinary methods of prevention. It is an active parasite, attacking and killing every

plant with which it comes in contact. The presence of a white mold at the base of the plant, rotting the leaf bases and the stem, and a sudden collapsing of plants, distinguish this disease from the Botrytis diseases with which it has been confused.

Another disease which is due to a species of Rhizoctonia, in which the lower leaves are first attacked, moist brown spots occurring, and the leaf blade rapidly rotted away, is briefly described. In this disease the center of the head becomes a black, slimy mass. A brief note is also given on a bacterial disease, which so far the authors have not met with in their investigations.

An extended account is given of experiments conducted for the control of the "drop" and Rhizoctonia diseases by sterilizing soil. Experiments show that where $\frac{3}{8}$ to $\frac{3}{4}$ of an inch of sterilized sand or earth is used as a covering to the buds the amount of disease is reduced 47 per cent; 1 in. of sterilized sand or earth reduces it 87 per cent; and when 2, 3, or 4 in. have been sterilized there is no disease whatever, when the plants had not been infected from contaminated material. The sterilization of soil is affected by heating it to about 160° F. Other methods of preventing these diseases were investigated, but aside from sterilization none were efficient. Freezing the soil had no effect upon the drop disease, and the development of the sclerotia was considerably accelerated by freezing. Drying the soil has a similar effect. The sterilization method of treatment will have no value upon such diseases as the Botrytis, mildew, bacterial rot, etc., which can be readily prevented by proper management of the crops, spraying, etc.

Orange culture and diseases, J. Borg (*Bul. Bot. Dept. Jamaica, n. ser.*, 7 (*1900*), *No. 9, pp. 129–142*).—This paper gives an account of orange culture and diseases in Malta. The principles of culture are briefly outlined and the diseases treated under the heads of insect diseases, those caused by fungus parasites, those due to errors in assimilation or unsuitable surroundings. Among the insects noted the most troublesome are 2 species of flies (*Halterophora capitata* and *H. hispanica*), and numerous scale insects. Of the fungus diseases described, the black blight or fumago, due to *Meliola penzigi*, the gummosis due to a number of species of Fusarium, Cladosporium, etc., and to the attacks of *Polyporus obliquus*, are described at some length. The diseases due to imperfect assimilation and improper surroundings are briefly described. Among these diseases are mentioned withers or lupa, which is the sudden death of part or the whole of a tree caused by the sudden occurrence of cool breezes after a protracted sultry calm in the hottest days of summer. It is said to be purely a physical disease, and frequent irrigation is suggested as the only remedy. Other diseases are brontosis, which is a name given to a disease causing the sudden death of trees in the winter; anthomania, the production of an extraordinary quantity of flowers; anthoptosis, the fall of

flowers without blooming; and carpoptosis, the fall of young fruit. These diseases seem to be due to defective nutrition and are largely influenced by the meteorological conditions of the season in which they appear.

A fig disease, G. MASSEE (*Gard. Chron., 3. ser., 28 (1900), No. 706, p. 5, fig. 1*).—A fig disease, due to *Cercospora bolleana*, is described. The fungus is of wide distribution, being known to occur throughout the entire Mediterranean region, in Austria, and also in Argentina. The leaf of the plant is the part most generally attacked, the fruiting branches of the fungus forming olive-green patches on the under surface of the leaf. On the upper surface, over these discolored areas, the leaf assumes a brown or russet tinge, eventually turning yellow and dropping. When a loss of foliage occurs on a large scale, the fruit is arrested in its development and also falls off at an early stage. In some instances the young fruits are attacked. Although a very destructive parasite when present in quantity, it appears that no serious attempt has been made to arrest its progress beyond collecting and burning its diseased fallen leaves. It is thought that spraying with Bordeaux mixture would doubtless be of service in preventing the spread of the fungus, if done in sufficient time.

The sulphuring of grapes, F. SIMONET (*Vigne Amer., 24 (1900), No. 5, pp. 143–145*).—The author reports upon a number of trials of a method of applying sulphur to the Othello variety of grapes. This variety is said to be extremely sensitive to the ordinary application of sulphur for the prevention of mildew. As a result of the experiments it is shown that these, or other very sensitive varieties, may be successfully treated for the prevention of oidium by applying the sulphur in what is termed the Garanger method, better known as "Grison liquid." This consists of boiling for 6 hours a mixture of equal parts of sulphur and recently slaked lime. The liquid is decanted off, and to each liter of the mixture from 40 to 60 liters of water are added. Four sprayings during the season are recommended.

Mercury in the products of vines sprayed with the mercurial mixtures, L. VIGNON and J. PERRAUD (*Sci. Amer. Sup., 49 (1900), No. 1262, p. 20238*).—On account of the rather wide use of corrosive sublimate as a fungicide, the authors have made an investigation of products of the grape to ascertain the percent of mercury in them. Draft wine, press wine, lees, the residuum, and the grapes themselves, from vines which had been treated with various fungicides containing corrosive sublimate, were investigated. The results of analyses show that the products of the fermentation of grapes treated with mercurial mixtures in the proportions tested contained only minute traces of mercury and consequently could be used without danger. The effect on the plant, however, showed that the use of corrosive sublimate was decidedly detrimental.

On the preventive treatment of smuts of cereals, G. ARIETE (*Staz. Sper. Agr. Ital., 33 (1900), No. 5, pp. 405–429*).—The literature of seed treatment for the prevention of smuts of cereals is briefly reviewed and an account given of experiments of the author in which copper sulphate, potassium sulphate, sodium sulphate, potassium permanganate, and formalin were used. The results of the different trials are given, from which it appears that all the fungicides exercised a beneficial effect in reducing the amount of smut, the best results being obtained when the seed was treated for 12 hours with a 5 per cent solution of copper sulphate, or 30 minutes with a 10 per cent solution, the results being practically identical. An extended bibliography of the subject concludes the paper.

Treatment of seed oats for smut, E. V. WILCOX (*Montana Sta. Bul. 22, pp. 24, 25*).—The cause and appearance of smut are described, and an experiment in which formalin was used as a preventive of oat smut is outlined. The oats were soaked for 2 hours in a solution of formalin, 1 lb. to 50 gal. of water. Comparisons were made with ordinary copper-sulphate treatment, the seed being sown upon contiguous areas. In its development from the grain treated with copper sulphate, smutty heads were numerous and conspicuous; while among the oats grown from the seed treated with formalin, but 2 or 3 smutty heads were found in a plat of about 2 acres.

Combating the corn smut (Ustilago maydis), S. DAVID (*Selsk. Khoz. i Lyesor., 197 (1900), June, pp. 553–566*).—By a series of experiments the author found that weak solutions of formaldehyde do not affect the power of germination of corn, but the spores of the corn smut are killed by such solutions. As the most suitable strength of the solution of formaldehyde, the author recommends one of 0.1 per cent, to whose action the seeds should be subjected for 4 to 5 hours.—P. FIREMAN.

Potato scab, E. V. WILCOX (*Montana Sta. Bul. 22, pp. 22, 23*).—A brief description is given of potato scab, together with results of a number of experiments for its prevention. The comparative value of gypsum, sulphur, corrosive sublimate, and formalin as means for the prevention of potato scab was tested. The results showed that formalin was not only the most efficient, but, being nonpoisonous, is easily handled.

Red mold of hops, W. H. HAMMOND (*Jour. Southeast. Agr. Col. Wye, 1900, No. 9, pp. 19, 20*).—The cause of this disease, which seriously affects the quality and yield of hops, is said to be the mildew of the leaves, *Sphærotheca castagnei.* Applications of sulphur or solution of potassium sulphid are recommended.

Orobanche cumana, V. SOUKOCHEV (*Selsk. Khoz. i Lyesor., 196 (1900), Jan., pp. 15–26*).—This parasite causes great injury to the sunflower in southern Russia. The author describes the germination and development of the plant parasite and the measures of combating it. The chief remedy is the pulling out of the parasite as soon as it shows itself and begins to blossom. This parasite suffers from the attacks of the fungus *Urocystis orobanches* and of the fly *Phytomyza orobanchia.*—P. FIREMAN.

Root knot of the peach, W. A. BOUCHER (*New Zealand Dept. Agr. Rpt. 1900, p. 334*).—An account is given of the occurrence of a disease of peach trees that is doubtless the same as crown gall. It is thought to have been introduced from California with a lot of peach seeds.

Bacteriosis of walnut, W. A. BOUCHER (*New Zealand Dept. Agr. Rpt. 1900, pp. 334, 335*).—A description is given of a bacterial disease of cultivated walnut trees. It is apparently the same as that occurring in California, which has previously been noted (E. S. R., 11, p. 261).

A new injury to trees, AUFFENBERG (*Oesterr. Forst u. Jagdw. Ztg., 18 (1900), No. 50, p. 396*).—Injury to vegetation about works erected for the manufacture of calcium carbid used in acetylene making is noted.

New disease on Caragana arborescens, A. YACHEVSKI (*Selsk. Khoz. i Lyesor., 196 (1900), Mar., pp. 663–666*).—The fungus discovered on the Caragana is taken by

the author to be a new species of the genus Phleospora, and he proposes the name *Phleospora caraganæ* for it. The new species most resembles, in its external appearance, *P. oxyacanthæ*. To protect the Caragana from the fungus, the author recommends the careful removal of the fallen leaves and the spraying of the trees in the spring with Bordeaux mixture.—P. FIREMAN.

Basal rot in narcissus, W. CRAWFORD (*Jour. Hort., 52 (1900), No. 2691, pp. 347, 348*).—A description is given of what is said to be one of the most destructive root diseases of narcissus. The name basal rot has been applied to this disease and in the author's opinion it is due to a species of Penicillium. The first indication of the disease is in the brown markings on the bulbs. These may be very slight or change the whole outer appearance into a discolored mass. While the fungus is ordinarily considered a saprophyte, the author believes it to be the true cause of the disease and recommends for its prevention the frequent rotation of crops and the use of commercial fertilizers.

ENTOMOLOGY.

Proceedings of the twelfth annual meeting of the Association of Economic Entomologists (*U. S. Dept. Agr., Division of Entomology Bul. 26, n. ser., pp. 102, pls. 2, fig. 1*).—At this meeting, held in New York City June 22, 23, 1900, the following papers were read:

Objects of the Association of Economic Entomologists, C. P. Gillette (pp. 5–15).—This paper is the address of the vice-president and contains a discussion of the objects of the Association.

The establishment of a new beneficial insect in California, L. O. Howard (pp. 16, 17).—*Scutellista cyanea* was brought to this country from Cape Colony by C. P. Lounsbury upon twigs infested with *Lecanium oleæ*. Previous attempts had been made in colonizing this parasite (E. S. R., 10, p. 1058).

Beneficial work of Hyperaspis signata, L. O. Howard (pp. 17, 18).—Brief notes on the agency of this insect in reducing the numbers of *Pulvinaria acericola* (E. S. R., 12, p. 160).

Some effects of early spring applications of insecticides on fruit trees, E. P. Felt (pp. 22–25).—Experiments were conducted in fighting the San José scale with mixtures of kerosene and crude petroleum in water in 20 and 25 per cent solutions, potash, whale-oil soap, and hydrocyanic-acid gas. The spraying was done on April 11 and the fumigation on April 19–21 on a mixed orchard of 100 young pear, peach, and plum trees. The results indicated that crude petroleum seriously injured the trees under certain conditions. The mechanical dilutions of this substance up to the strength of 25 per cent appear to be harmless if applied before the buds open.

The relations of Pimpla conquisitor to Clisiocampa americana, C. M. Weed and W. M. Fiske (pp. 33, 34).—This parasite is reported as attacked when nearly full grown by a secondary parasite, *Theronia fulvescens*. *Pimpla conquisitor* occurs both as a primary and as a secondary parasite of the tent caterpillar.

Observations on Diabrotica 12-punctata, A. L. Quaintance (pp. 35–40).—This beetle was reported as abundant in Georgia. The first

adults were seen March 12, the first signs of injury on May 2, and the first pupæ May 8. The insect was observed on a large number of food plants. Laboratory observations were made on the egg-laying habit and the extent of the life cycle. Experiments were conducted in planting corn deep, shallow, early, late, with an excess of seed in the hills, and drilled; plats were also planted with seed corn soaked in strong kerosene emulsion, diluted kerosene emulsion, chlorid of lime, or soaked in tar and in sulphur made adhesive by moistening with molasses; 1 plat was treated with kainit at the rate of 2,000 lbs. per acre; another plat was sprayed with kerosene emulsion around the hills; tobacco dust was also placed in each hill of 1 plat. The seed corn soaked in strong kerosene emulsion was considerably injured and a larger percentage of larvæ was noted in the plats treated with kainit than in other plats. None of the methods of treatment except late planting had any appreciable effect in reducing the number of larvæ.

Notes on some African ticks, *C. P. Lounsbury* (pp. 41–49).—A brief discussion of *Amblyomma hebræum*, *Hyalomma ægyptius*, *Rhipicepalus decoloratus*, *R. evertsi*, *Onithodoros savignii*, and *Argas persicus*.

Notes on Coccidæ of Georgia, *W. M. Scott* (pp. 49–54).—Brief notes on about 40 species of Coccidæ observed in this State.

Notes upon the destructive green-pea louse for 1900, *W. G. Johnson* (pp. 55–58).—The brush and cultivator method is reported as being a simple and rather effective means of destroying *Nectarophora destructor*. No practical spraying method has been found.

Hydrocyanic-acid gas as an insecticide on low growing plants, *E. D. Sanderson* and *C. L. Penny* (pp. 60–66).—This paper contains a record of experiments in fumigating small plants in the field and in boxes. (See E. S. R., 12, p. 162.)

Notes from Delaware, *E. D. Sanderson* (pp. 66–72).—Brief notes on a number of injurious insects, including the horse bot fly, green-apple aphis, destructive green-pea louse, and ladybird beetles.

Aphelinus fuscipennis, an important parasite upon the San José scale in Eastern United States, *W. G. Johnson* (pp. 73–75).—Brief notes on the extent of parasitism of the San José scale by this parasite.

Entomological notes from Colorado, *C. P. Gillette* (pp. 76–80).—In experiments to test the extent of spring migration of the codling moth, a number of larvæ were found under bands around trees, but not sufficient to warrant the adoption of this method for combating the first brood. Brief notes are also given on the peach-twig borer, woolly aphis, San José scale, California mite, and *Laphygma flavimaculata*.

Notes on insects of economic importance for 1900, *W. G. Johnson* (pp. 80–84).—Brief notes on asparagus beetles, destructive green-pea louse, Mediterranean flour moth, and San José scale.

Insects of the year in Ohio, *F. M. Webster* (pp. 84–90).—Brief notes on the Hessian fly, fall army worm, *Carneades tessellata*, *C. insignata*,

onion thrips, destructive pea louse, *Myochrous denticollis*, *Harpalus caliginosus*, and *Saperda vestita*.

Notes from California, *C. W. Woodworth* (pp. 90–94).—Notes on *Lecanium oleæ*, the San José scale, codling moth, peach-twig borer, phylloxera, and *Typhlocyba comes*.

Notes from Canada, *J. Fletcher* (pp. 94–96).—A brief account of *Cacœcia rosaceana* and some of the common insect enemies of roots, vegetables, cereals, forage plants, trees, and shrubs.

First report on insect pests for 1899, F. V. THEOBALD (*Jour. Southeast Agr. Col. Wye, 1900, No. 9, pp. 21–48, figs. 25*).—The author discusses the habits, life history, and remedial measures against the asparagus beetles (*Crioceris asparagi* and *C. 12-punctata*). Among the natural enemies of the first species the author mentions ladybirds, lace-wing flies, and *Anthocoris nemorum*. Hand picking of the larvæ is recommended in gardens which are badly infested with these insects. Chickens and ducks also render valuable service in reducing the number of the beetles.

A species of thrips is reported as injurious to the scarlet runner bean. Infested plants are readily discernible by the fact that the lower petals become rapidly shriveled from the attacks of this insect. A detailed description is given of the species, and brief notes on its life history. For combating this species, and also *Thrips pisivora*, the author recommends the destruction of all bark and rubbish under which the insects might hide and the use of such insecticides as pyrethrum and tobacco.

The author worked out anew the complete life history of the hop aphis (*Phorodon humuli*). The eggs of this species are found in winter on prune trees, and from these eggs viviparous wingless females are hatched, of which there were 3 generations. During June winged viviparous females were produced, some of which migrated to hops. In the fall female and male migrants returned to the prune trees, where the insect hibernated in the egg stage. The author believes that the cultivation of prunes and plums in the neighborhood of hop gardens is partly responsible for unusual outbreaks of the hop louse. Brief notes are also given on *Melolontha vulgaris* as an enemy of the hop. The burdock moth (*Gortyna flavago*) is reported as having caused considerable damage to tomatoes. The larvæ of this insect enters the stems of various other plants beside the tomato and burrows upward in the central pith. The recorded food plants of the species are ragwort, burdock, dock, and thistles. The author presents brief notes on the considerable number of injurious insects, among which mention may be made of flea-beetles on cabbage and other garden vegetables, apple-blossom weevils, wheat midge, and pear midge.

The Hessian fly in 1899 and 1900, F. M. WEBSTER (*Ohio Sta. Bul. 119, pp. 237–247*).—The Hessian fly was unusually destructive to

wheat in Ohio during the fall of 1899 and the spring of 1900. The conditions which were favorable to the relative abundance of the Hessian fly were the decrease in the number of its natural enemies, a mild autumn, and a severe drought which retarded the development of the fall brood to such an extent that the flies emerged in time to be most destructive to late sown wheat. The Hessian fly emerges about one month earlier in the fall over the northern parts of the State than in the southern parts. Throughout Ohio, except in the northwest and southwest portions, the rainfall in August, 1899, was below the normal. During September the temperature was low and heavy rains occurred on the 18th and 25th of this month. Soon after these rains the fall brood of the Hessian fly emerged and attacked the young wheat which required a longer time than usual for germination on account of the drought. The author believes that the Hessian fly will probably continue to be very destructive for another season. It is possible, however, for the farmer to regulate to some extent the time of sowing wheat by the weather conditions, remembering that the fall brood of the Hessian fly emerges within a few days after a heavy rainfall. It is not advisable to sow wheat for 2 successive years on the same ground and it should be remembered that the Hessian fly attacks rye and barley as well as wheat.

The Hessian fly in West Virginia and how to prevent losses from its ravages, A. D. Hopkins (*West Virginia Sta. Bul. 67, pp. 239–254, pls. 2, map 1*).—The author gives a brief summary of the life history of the Hessian fly. In West Virginia there are 2 broods of this insect a year, and the time of appearance of the fall brood is modified more by altitude than by latitude. The author gives a brief statement of the ordinary methods used in controlling the Hessian fly, including burning of the stubble, plowing under stubble, destruction of volunteer wheat, sowing trap strips of wheat, and crop rotation. It is stated that the period for sowing wheat extends over about 15 or 20 days, beginning about a week earlier than the average date for the disappearance of the fall brood of Hessian flies, and ending from 1 week to 16 days later than this date. The disappearance of the fall swarm or period of active flight is, according to the author, governed by a natural law which "causes it to vary at the rate of about 4 days for each degree of latitude (earlier toward the north and later toward the south) and 4 days earlier for each 400 feet of altitude above sea level." The average dates for the disappearance of the fall brood in different parts of the State are given on a map which accompanies the bulletin.

Experiments with insecticides upon potatoes, C. D. Woods (*Maine Sta. Bul. 68, pp. 169–192*).—This bulletin contains a report upon experiments with several commercial insecticides in comparison with Paris green as a remedy for the potato beetle. For these experi-

ments a ten-acre field was placed at the disposal of the experiment station. This field was planted with Green Mountain potatoes in April and divided into 14 plats of 16 rows each, with 2 plats of shorter rows at either end. As insecticides Paris green, Boxal, Paragrene, arsenate of lead, and Arsenoids Nos. 2, 3, 4, and 5, were used. The insecticides were applied with water, together with a fungicide, either Bordeaux mixture or other similar materials. One-half the field was sprayed July 11 and the other half on July 13. The whole field was sprayed July 21 and 27 and one-half on August 10 and the other half on August 11. A Vermorel nozzle was used for the first application over each row and the rows were passed over twice in opposite directions. The other applications were made with a double Vermorel nozzle.

Three applications of Paris green at the rate of ½ lb. per acre kept the potato beetles so reduced in numbers that the fourth application on August 10–11 was unnecessary. Applied at the rate of ½ lb. to 2 lbs. of lime per acre, Paris green was more effective in killing the bugs than when mixed with Bordeaux mixture, the latter being apparently so distasteful to the beetles that they left the thoroughly sprayed leaves, and thus avoided the leaves with the most Paris green. Paragrene was applied 4 times with Bordeaux mixture at the rate of ½ lb. per acre. The Paragrene used in the experiment was coarser than Paris green, and there was some residue which would not go through a fine Vermorel nozzle. The potato beetles were all destroyed, and only a slight injury to the foliage was noticed. Field notes made on the experiments with the Arsenoids show that these substances were as effective as Paris green, but less so than arsenate of lead. They contain more free arsenious acid than the best Paris green. Arsenate of lead is the poisonous element in Boxal and Disparene. Rows 97 to 112 were treated 4 times with arsenate of lead and Bordeaux mixture at the rate of 1 lb. per acre. On August 14 it was noted that the beetles were all destroyed. Boxal was also applied 4 times at the rate of 5 lbs., and in another plat at the rate of 10 lbs. per acre. The larger application was more effective in destroying the potato beetles. Disparene was applied to a field of 3 or 4 acres with satisfactory results.

A number of experiments were conducted with Bug Death as an insecticide. It was found that this substance would cost $8 per acre for each application and that 2 applications about a fortnight apart would be necessary to free the potatoes from the beetles. The process of applying this insecticide is slow and laborious. The substance is chiefly zinc oxid and contains no nitrogen and only a trace of phosphoric acid and potash. It can not therefore be considered a fertilizer. At the rate of 100 lbs. per acre this substance freed potato vines from the beetles. The beetles, however, were not killed but merely driven

away. The great cost and slow process of application of this substance renders it an imperfect insecticide. Black Death was also applied once on ¼ acre of potatoes at the rate of 40 lbs. per acre. It had no appreciable effect upon the beetles.

The author concludes that there is no good substitute for arsenical poisons in combating the Colorado potato beetle. Arsenical poisons are best applied with water in the form of a fine spray in conjunction with Bordeaux mixture or lime. Some of the cheaper arsenoids were as effective as Paris green. Lead arsenate was the most satisfactory of all insecticides used during the experiments.

Economic and biological notes on insects injurious to herbaceous crops in the Valley of Bientina, G. DEL GUERCIO (*Nuove Relaz. R. Staz. Ent. Agr., 1. ser., 1900, No. 2, pp. 269–303, figs. 31*).—A critical review is presented of the literature relating to *Agrotis ypsilon*, in connection with a brief bibliography of the subject. Detailed descriptions are given of this insect in all its stages, and a brief discussion is presented of its life habits and metamorphoses. The more common host plants of this insect in Italy are said to be beans, kidney beans, potatoes, hemp, tobacco, cotton, etc. The conditions which are favorable to the development of this insect are a dry, windy winter, followed by a spring relatively cold and wet. The insects which were noticed preying upon this cutworm were *Hister 6-striatus*, *Formica rufa*, and *Polyergus rufescens*. A bacterial disease was noticed among the cutworms and several cutworms were destroyed by *Oospora guerciana*. The more important insect parasites are *Meteorus scutellator*, *Microplitis mediana*, *Erigorgus melanobatus*, *Ceolopistus cephalotus*, etc.

The author recommends the usual remedies adopted for cutworms and army worms in combating this insect.

The effect of scale lice upon vegetable tissues, J. KOCHS (*Bot. Mus., Abt. Pflanzenschutz, Hamburg, 2 (1900), pp. 16*).—The author made an investigation of the cause of spots of various colors found on the exterior of fruits. Red spots were found on peaches, pears, and apples, and were due to the attack of *Diaspis pentagona*, the San José scale, Forbes scale, Putnam scale, and the scurfy scale. Yellow spots were found on pears and were due to the attack of the oyster-shell bark-louse and *Aspidiotus pyri*. Yellowish green spots were found on apples, and were caused by the presence of *Rœstelia pirata*. Green spots observed on apples and lemons were attributed to the attacks of *Aspidiotus ancylus* and *A. nerii*. Bleached spots were observed on oranges, and were caused by the attack of *Parlatoria proteus* and *P. zizyphi*.

On the skins of oranges only a slight discoloration was produced by the attacks of scale lice, while ripe lemons showed round spots of 10 mm. from the same cause. An investigation of the green spots showed

an absence of soluble yellow coloring matter, while chlorophyll grains were present in abundance. A similar local checking of the ripening process was also observed on varieties of apples attacked by various fungi. In investigating the red spots, 2 forms were distinguished. The one is in the cavities in either end of the fruit, while the other was found on the convex surface of the fruit. In the former case, the spots were elongated and arranged somewhat in a radial manner about the center of the cavity, while in the second case, the spots were more nearly round. The San José scale was found to produce the largest and most intensely colored spots. In these respects the Putnam scale comes second in the series, and the Forbes scale third. The form of the spots produced by the scurfy scale is peculiar, appearing nearly as a double spot in each case. The author believes that the formation of red spots is due to a hastening of the maturation process, which takes place at the point where the beak of the insect is inserted. The stable carbohydrates are believed to be changed by means of enzyms which come from the infecting insects.

The author further discusses the various forms of local swellings and excrescences produced on fruits and other vegetable tissues by the attacks of various scale lice.

Economic and biological notes on Simæthis nemorana (*Nuove Relaz. R. Staz. Ent. Agr., 1. ser., 1900, No. 2, pp. 305–328, figs. 14, pl. 1*).—This insect is distributed most abundantly, according to the author, through central Europe, while France and Italy seem to suffer most from its attacks. The host plant is the fig. The author describes the insect in all its stages. The insect attacks the buds, leaves, and bark of the tender twigs of the fig. The conditions most favorable for the development and wide distribution of this insect are an abundance of the fig and sunny localities well protected from the wind. The insect parasites which assist most materially in checking the ravages of this fig insect are *Angitia armillata*, *Pimpla alternans*, *Phaogenes impiger*, and *Masicera casta*.

A number of insecticides were used in combating this insect, among which the following may be mentioned: Soap 2 kg., water 100 liters; soap 1½ kg., carbon bisulphid 0.3 liter, water 100 liters; alkaline tar 2 kg., water 100 liters; alkaline tar 1½ kg., bisulphid of carbon 0.3 liter, water 100 liters.

Observations on the development and use of the locust fungus in German southwest Africa, RICKMANN AND KAESEWURM (*Notizbl. K. Bot. Gartens u. Mus., Berlin, 3 (1900) No. 24, pp. 65–74*).—The authors received 50 test tubes containing cultures of the locust fungus from Cape Colony. Experiments were made in transferring this material to other test tubes for the purpose of obtaining pure cultures. Microscopic examinations of the material showed that the fungus was closely related to *Mucor racemosus*. Experiments with this fungus indicated

that the locusts died from 4 to 6 days after being inoculated. The best results were obtained in the presence of a moderately moist surrounding. In spreading the infection several methods may be adopted. A number of locusts may be captured, dipped in a solution containing the fungus, and then replaced in the swarm. Small areas of ground frequently visited by the locust may be infected with the same solution. For infecting the locust in the immature wingless stages, about a pound of white bread was dried, pulverized and made into a rather thick gruel; this mass was then inoculated with pure cultures of the fungus, and after the fungus had developed so as to be readily seen, portions of the infected mass were placed in locations where the immature locusts might be likely to feed.

The honeybee, G. G. NAYLOR (*West Virginia State Bd. Agr. Rpt. 1899-1900, pp. 202-209*).—Popular notes on *Apis dorsata* and on various practical matters connected with bee keeping.

Apiarian notes, J. P. PROVAN and H. G. BURNET (*Jour. Jamaica Agr. Soc., 4 (1900), No. 1, pp. 663-666*).—The authors found that the amount of swarming was considerably reduced where 20 frames were allowed for each queen. The Italian bees did not swarm as much as the dark hybrids, and the queens of the latter were therefore killed off and replaced with Italian queens.

The determination of sex in bees, SCHILLER-TIETZ (*Fühling's Landw. Ztg., 49 (1900), Nos. 18, pp. 665-673; 19, pp. 715-717; 20, pp. 755-760*).—In this article the author presents an elaborate discussion of the problem of the determination of sex in the honeybee. The author does not accept in its entirety either the theory of Dzierzon or that of Dickel, but inclines to the belief that the sex of the bees is already determined in the egg at the time it is laid.

The pantry moth, S. F. AARON (*Sci. Amer., 83 (1900), No. 16, pp. 250-253, figs. 7*).—Brief notes on the life history, habits and means of combating *Plodia interpunctella*.

Bibliography of clinical entomology, J. C. HUBER (*Bibliographie der klinischen Entomolgie. Jena: H. Pohle, 1899, Nos. 1, pp. 24; 2, pp. 24; 3, pp. 25; 1900, No. 4, pp. 27*).—The author gives bibliographical references on literature relating to Sarcopsylla, Pulex, Acanthia, Pediculidae, Demodex, Leptus, Dermanyssus, Argas, Ixodes, Pediculoides, Tetranychus, Tyroglyphus, Sarcophila, Sarcophaga, Calliphora, Anthomyia, Musca, Lucilia, Teichomyza, Compsomyia, Hypoderma, Dermatobia, Ochromyia, *Sarcoptes scabiei*, and *Symbiotes felis*.

A list of the biting lice (Mallophaga) taken from birds and mammals of North America, V. L. KELLOGG (*Proc. U. S. Nat. Mus., 22 (1900), pp. 39-100*).—The author presents an analytical table for the determination of species belonging to this order of insects. The species are listed with bibliographical notes and indications of their hosts. The number of Mallophaga recorded from North American host animals amounts to 282 species, of which 264 are from birds and 18 from mammals. A list is also given of the host animals, with indications of the Mallophaga which occur upon each species.

Report of the botanist and entomologist, G. W. HERRICK (*Mississippi Sta. Rpt. 1900 pp. 40-42*).—The liming of soil apparently had a beneficial effect in checking the development of tomato blight. The author has undertaken work on insects injurious to pecans. Experiments were conducted for the destruction of horn-fly. Cattle were sprayed with mechanical mixtures of kerosene and water containing 10, 15 and 17 per cent. It was found that the flies were destroyed if the spray was brought in contact with them. They frequently leave the back of the animal and lie upon the belly, and it is therefore necessary to direct the spray accordingly.

Insects injurious to garden and field crops, fruits, forest trees, man, and domestic animals; their life history, injuries and methods of preventing them. III. Hymenoptera and Diptera, G. LEONARDI (*Sci. Prat. Agr., 11 (1900), No. 3, pp. 549, figs. 249*).—This book constitutes Vol. 3 of a general treatise on injurious insects, of which Vol. 1 was published in 1889, and covered the subject of general entomology and Coleoptera; and Vol. 2 was published in 1894, and included a discussion of injurious Lepidoptera. These 2 volumes were written by A. Lunardoni. The present volume gives a discussion of the life history and habits of injurious Hymenoptera and Diptera, together with suggestions of the approved remedies for combating these insects. A very large number of species is included, the discussion of which species is fairly complete. The family Pulicidæ is included under the Diptera. Extensive bibliographical references are given in the volume.

The plagues of field crops, P. CONDE (*Bol. Soc. Nac. Agr. [Lima], 4. ser., 11 (1900), No. 3, pp. 170-172*).—Brief general notes on the depredations committed by injurious insects upon the common field crops.

Losses caused by the grain aphis, E. V. WILCOX (*Montana Sta. Bul. 22, pp. 25, 26*).—Several heads of each of a large number of varieties of wheat were inclosed with a netting so as to prevent the attacks of the grain aphis. One hundred grains from such heads were then compared in size, weight, and appearance with 100 grains of the same variety from heads which had been infected with the grain aphis. It was found that before the grain had been allowed to dry, the weight of the protected and unprotected grain of any variety was approximately the same. During the process of drying, however, the grains from infected heads shriveled up to a considerable extent and the loss in weight as compared with grain from uninfected heads was found to be from 15 to 35 per cent.

The economic entomology of the sugar beet, S. A. FORBES and C. A. HART (*Illinois Sta. Bul. 60, pp. 397-532, pls. 9, figs. 97*).—In this bulletin the authors have compiled brief accounts of the habits, life histories, and means of combating all insects which are known to attack the sugar beet in the United States. The number of species discussed is about 150. A bibliography of the subject is added to the bulletin.

The locust plague and its suppression, A. MUNRO (*London: John Murray, 1900, pp. 365, figs. 45*).—The author gives a detailed discussion of the locust plague in Argentina and in South Africa. The subjects considered in the volume include an account of the appearance, habits, and life history of the locust, correspondents' and newspaper accounts relating to the subject, and an elaborate discussion of the natural enemies and artificial means for combating these insects. The natural agencies recognized by the author are winds, birds, reptiles, mammals, insect parasites, and fungus diseases. Among the mechanical means for fighting locusts mention may be made of trampling by means of herds of sheep and cattle, rolling with heavy rollers propelled by steam or in front of horses; the use of wire flails; and various forms of hopperdozers and Carcaranya machines. A considerable discussion is also given to various forms of traps, ditches and trenches with and without water, pits, barriers of various sorts, burning, and scalding by means of steam. Among the chemical substances used in the destruction of locusts the following are discussed: Arsenical solutions, arsenic and treacle, Paris green, London purple, coal tar, creosote, paraffin, carbolic acid, and petroleum.

Locust destruction (*Agr. Jour. Cape of Good Hope, 17 (1900), No. 11, pp. 684-686*).—The Government of the Cape of Good Hope has undertaken to bear two-thirds of the expense of spraying materials and to furnish spray pumps where possible, for the purpose of destroying swarms of immature locusts. The sprays which were recommended are Blue Mottled Soap, Little's fluid dip, Odam's fluid dip, glycerin dip, and Sunlight Soap. W. R. Ellis reports the results from using some of these dips. Odam's dip used in the proportion of 1 gal. to 5 gal. of cold

water killed all locusts in from 5 to 15 minutes. Blue Mottled Soap in proportion of $1\frac{1}{2}$ lbs. to 5 gal. of water caused the death of locusts upon which it was sprayed within about 5 minutes.

Injurious fruit insects; insecticides; insecticide apparatus, R. A. Cooley (*Montana Sta. Bul. 23, pp. 64–114, figs. 39*).—Brief popular notes on the codling moth, tent caterpillar, gooseberry fruit worm, pear slug, round-headed apple-tree borer, flat-headed apple-tree borer, plum curculio, San José scale, oyster-shell bark-louse, scurfy bark louse, woolly aphis, tarnished plant bug, pear psylla, currant flies, and pear-leaf blister mite. Directions are given for the preparation and use of the common insecticides.

Ceratovacuna lanigera, the white plant louse of the sugar cane leaves, L. Zehntner (*Meded Proefstat. Suikerriet, West Java, No. 49, pp. 30, pls. 2*).—The author believes that the injury caused to sugar cane by this species is greater than has usually been supposed. The insect is described in detail in all its stages. The natural enemies of these plant lice are rather numerous and active in its destruction. Among the more important ones mention may be made of *Encarsia flavoscutellum*, species of Chrysopa, Osmylus, ladybirds, and *Ephestia cautella*.

Scale lice. Description and means of combating the most important scale lice of the German fruit and grape industries, A. B. Frank and F. Krüger (*Schildlausbuch. Beschreibung und Bekämpfung der für den deutschen Obst- und Weinbau wichtigsten Schildläuse. Berlin: Paul Parey, 1900, pp. 120, figs. 59, pls. 2*).—This work contains a general discussion of the biology and economic importance, and means of combating the more injurious scale lice of Germany. The following subjects are considered: Classification of the subfamilies of scale lice; the development of scale lice; methods of reproduction; their influence on the host plants; means of infestation of fruit trees and the natural enemies of scale lice; the direct and indirect artificial remedies, including the care of trees, mechanical and chemical remedies, such as lime water, arsenical preparations, creosol, lysol, soaps, petroleum, and hydrocyanic-acid gas; a descriptive and systematic account of the genera Aspidiotus, Diaspis, Mytilaspis, Parlatoria, Lecanium, and Pulvinaria; and tables for the identification of the more important species.

Scale on fruit trees (*Jour. Jamaica Agr. Soc., 4 (1900), No. 12, pp. 719, 720*).—This paper constitutes the first of a series of leaflets which are to be issued by the Board of Agriculture. It contains directions for preparing kerosene emulsion.

Locomotion of the larvæ of scale lice, L. Reh (*Bot. Mus., Abt. Pflanzenschutz, Hamburg, 2 (1899–1900), pp. 6*).—In order to determine the rapidity with which the larvæ of scale lice may move, the author placed a number upon a sheet of paper and traced the course of the larvæ by means of a pencil. It was found that the larvæ of the oyster-shell bark-louse moved from $1\frac{1}{2}$ to 2 cm. per minute, while the larvæ of *Diaspis ostreæformis* traveled about $1\frac{1}{2}$ cm. per minute.

How to control the San José scale, C. L. Marlatt (*U. S. Dept. Agr., Division of Entomology Circ. 42, 2. ser., pp. 6*).—The author believes that the San José scale can not be exterminated where it has once become well established, but that it can be successfully controlled. The most important insecticide methods for controlling this insect are the lime, salt, and sulphur wash in California and in the East whale-oil soap, pure kerosene, crude petroleum, mechanical mixtures of either kerosene or crude petroleum with water, and fumigation with hydrocyanic-acid gas. Brief directions are given for the preparation and use of these insecticides.

The structure of the border of the last abdominal segment of the San José scale, H. Meerwarth (*Bot. Mus., Abt. Pflanzenschutz, Hamburg, 2 (1899–1900), pp. 15, pl. 1, figs. 5*).—This article is a detailed study of various anatomical features connected with the exterior of the posterior abdominal segment of this insect.

Report on the activity of the section for plant protection for 1899, C. Brick (*Bot. Mus., Abt. Pflanzenschutz, Hamburg, 2 (1899–1900), pp. 3*).—The author

gives a detailed report on the number of crates, barrels, and baskets of fresh American fruit received in Hamburg, and on the proportion which were found to be infested with the San José scale.

Aspidiotus ostreæformis and related species, L. REH (*Bot. Mus., Abt. Pflanzenschutz, Hamburg, 2 (1889–1900), pp. 13, fig. 1*).—Upon examination, the author found that the species hitherto known in Germany as *A. ostreæformis* is really *A. pyri*, and that the true ostreæformis also occurs in Germany. The detailed description of the species is therefore given.

Sumach as a remedy for combating Phylloxera, G. FLORIANO (*Staz. Sper. Agr. Ital., 33 (1900), No. 1, pp. 45–55*).—Infusions of the wood and leaves of this plant were placed in the soil around infested grapevines for the purpose of determining whether the substance had any destructive effect upon Phylloxera. Entirely negative results were obtained in all experiments.

The life history of Arctia phalerata, A. GIBSON (*Canad. Ent., 32 (1900), No. 12, pp. 369–376*).—The author describes the egg of this species, 7 stages in the larval development, and the pupa. The length of the pupal stage was found to be about 12 days. The food plants of the first brood were dandelion and plantain; the second brood was found only on the dandelion.

The structure and life history of the harlequin fly, L. C. MIALL and A. R. HAMMOND (*Oxford: Clarendon Press, 1900, pp. 191, pl. 1, figs. 129*).—In this book the authors have described in detail the life history and relations of *Chironomous dorsalis* to other Diptera, the larva, pupa, adult and embryonic conditions, and various anatomical, histological and other details connected with the structure of this insect. A bibliography is appended to the book.

On the genera of the chalcid flies belonging to the subfamily Encyrtinæ, W. H. ASHMEAD (*Proc. U. S. Nat. Mus., 22 (1900), pp. 323–412*).—The author gives an analytical table for the determination of species, together with descriptions of a number of new species.

A new sporozoon in the larvæ of Diptera, L. LÉGER (*Compt. Rend. Acad. Sci. Paris, 131 (1900), No. 18, pp. 722–724*).—A new species of this group of animal organisms was found in larvæ of the genus Ceratopogon, and is named *Schizocystis gregarinoides* by the author. Brief notes are given on the anatomical characters and metamorphoses of this parasite in the intestines of the host.

Note on Cordyceps sinclairii, W. B. BENHAM (*Trans. and Proc. New Zealand Inst., 32 (1899), pp. 4–8, pl. 1*).—This species of fungus was found by the author in New Zealand, infesting the larva of a species of Cicada. The fructification of most of the species of Cordyceps hitherto studied is known only in the ascospore stage. This species, on the other hand, was found by the author in the conidiospore stage.

Directions for collecting and rearing dragon flies, stone flies, and May flies, J. G. NEEDHAM (*Extr. U. S. Nat. Mus. Bul. 39, 1899, pp. 9, figs. 4*).—Brief directions for collectors and students of these groups of insects.

Fumigation with hydrocyanic acid, H. H. COUSINS (*Jour. Southeast Agr. Col. Wye, 1900, No. 9, pp. 67–70*).—Experiments were made in cooperation with Mr. T. V. Theobald, in treating currant bushes by this method for black currant bud mite. Infested currant bushes which were intended for planting were placed in a heap on the ground, covered with canvas and subjected to the fumes of hydrocyanic acid for about one hour. All the mites were killed by this treatment. In applying this method to currant bushes growing in the field, it was found that the chemicals would cost about $12 per acre.

Experiments with hydrocyanic-acid gas were also made in vineries and greenhouses, for the purpose of testing the efficiency of this method in destroying the mealy bug. The experiments gave satisfactory results and no injury was noted on the foliage of chrysanthemums, maidenhair ferns, and other plants which were subjected to the treatment.

FOODS—ANIMAL PRODUCTION.

Studies on the amount of nutrients required by man at rest, K. ELKHOLM (*Skand. Arch. Physiol., 11 (1900), Nos. 1-2, pp. 1-96, dgms. 2*).—The balance of income and outgo of nitrogen was studied with students, soldiers, and aged men, the Sondén and Tigerstedt respiration apparatus being used (E. S. R., 8, p. 242). The energy furnished by the food consumed and utilized by the subjects is calculated. The author discusses his results at length, comparing his experiments with similar investigations made elsewhere. According to the author, the students in these experiments required on an average 1,156 calories per square meter of surface area; the soldiers, 1,186 calories; or taking the average of the two groups of young men, 1,171 calories. A man weighing 70 kg., whose surface area equals 2.0912 square meters, would therefore need daily 2,450 calories net, while on the supposition that 10 per cent of the fuel value of the food is lost in the feces, he would need a total of 2,700 calories, or calculated on the basis of body weight, 35 and 38.6 calories, respectively, per kg. The author believes further that the results of the numerous dietary studies which have been made are in accord with these values. The article concludes with an extended bibliography.

On the elimination of nitrogen, sulphates, and phosphates after the ingestion of proteid food, H. C. SHERMAN and P. B. HAWK (*Amer. Jour. Physiol., 4 (1900), No. 1, pp. 25-49, dgms. 3*).—The authors (healthy young men under normal conditions of nutrition) were themselves the subjects of experiments in which the amount of protein was increased at different times in an otherwise practically uniform diet. In one case the fat was correspondingly diminished. The income and outgo of nitrogen were determined, as well as the heat of combustion of the urine. The excretion of nitrogen, sulphur, and phosphorus in the urine was determined at frequent intervals with the object of ascertaining how soon after the consumption of protein its cleavage products are excreted.

"As measured by 3-hour periods, the rates of excretion of nitrogen and sulphates run closely parallel and normally show a tendency to rise during the morning, reaching a maximum after the midday meal, with a slight fall in the following period and another rise after the evening meal. During the night the excretion usually reaches the minimum.

"The excretion of phosphates on the normal days described a curve altogether different from that of nitrogen and sulphates, rising steadily from the middle of the morning until the time of retiring, then falling during the hours of sleep and continuing to fall for 3 hours after rising, reaching a minimum after breakfast.

"When lean beef sufficient to furnish about 63.7 gm. of extra protein was taken with breakfast, the nitrogen began to rise in the first 3 hours and reached a maximum between the sixth and ninth hours, after which it declined at first rapidly and then more slowly, reaching the normal after about 36 to 39 hours.

"The increased excretion of sulphates was proportional to that of nitrogen and followed the same general course. It appeared, however, to begin a little later, and certainly regained the normal a little earlier.

"The increase in the rate of excretion of phosphates apparently began a little later, but reached a maximum at the same time with that of nitrogen, after which it fell rapidly, regaining the normal about 12 to 15 hours after the ingestion of the beef.

"The increased heat of combustion of the urine was but little greater than would correspond to an amount of urea equivalent to the extra nitrogen eliminated. This would seem to indicate that the total amount of the less highly oxidized constituents of the urine was but little affected.

"The nature and extent of the changes in the urine seem to have been about the same when the protein was simply added to the diet as when it was substituted for an isodynamic amount of fat.

"A moderate gain or loss of body nitrogen does not seem to affect the changes noted."

Digestion trials, J. FIELDS and A. G. FORD (*Oklahoma Sta. Bul. 46, pp. 8*).—The digestibility of a number of grains was tested with chickens and that of forage crops with sheep.

Digestion trials with chickens.—The digestibility of Kafir corn, maize, and cowpeas, ground and unground, was tested with 3 cockerels. The experiments in general consisted of a 5-day period preceded by a preliminary period of 2 days. The chickens were supplied with coarse sand and water, *ad libitum.* The amount of sand eaten was recorded and was quite considerable, ranging from 72.6 to 296 gm. per day. The average coefficients of digestibility obtained are shown in the following table:

Results of digestion experiments with chickens.

	Organic matter.	Protein.	Ether extract.	Nitrogen-free extract.	Crude fiber.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Kafir corn	87.7	52.9	20.1	96.3	73.7
Kafir corn meal	87.2	42.6	35.5	96.5	82.7
Maize	86.4	49.8	....	92.5	91.7
Maize meal	85.5	48.4	....	91.5	93.1
Cowpeas	71.5	40.5	18.4	87.1	88.7
Cowpea meal	72.2	43.7	9.6	87.8	88.7

"Chickens digested Kafir corn and corn more completely when the grain was fed whole than when the meal was fed. The Kafir corn and Kafir meal fed in this trial yielded but 2 per cent less total digestible matter than the corresponding corn products. Kafir corn was a more suitable ration, considering only the relative amounts of growth-making and fat-forming materials, for chickens than Kafir meal, corn, or corn meal. Cowpeas were digested reasonably well and are desirable feed for growing chickens and hens. But little gain in digestibility was secured by grinding the cowpeas."

Digestion trials with sheep.—The digestibility of a number of coarse fodders was tested with sheep. The average results follow.

Digestibility of a number of forage crops by sheep.

	Dry matter.	Protein.	Ether extract.	Nitrogen-free extract.	Crude fiber.	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Kafir	57.9	41.7	64.8	66.9	54.1	11.1
Corn	62.1	44.3	75.5	71.1	52.5	4.6
Small sorghum	56.0	15.7	75.2	67.0	46.3	12.4
Large sorghum	54.0	17.0	80.1	60.3	53.1	16.4
Black rice corn	52.0	25.3	64.2	62.1	44.5	20.6
Millo maize	51.7	16.2	63.0	60.7	50.9	7.7

Digestion experiments with sheep, J. M. BARTLETT (*Maine Sta. Bul. 67, pp. 133–168*).—Following the usual methods, experiments on the digestibility of a number of feeding stuffs were made with sheep, the average results of which follow:

Average digestion coefficients obtained with sheep.

Feeding stuff.	Dry matter.	Organic matter.	Protein.	Fat.	Nitrogen-free extract.	Crude fiber.	Ash.	Available fuel value.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Clover hay, cut in early bloom	57.6	59.0	65.9	27.9	62.9	51.8	44.6	53.3
Clover hay, cut in late bloom	55.6	57.2	67.3	35.4	64.3	43.6	38.5	51.0
Clover silage made from clover cut in late bloom	52.3	53.3	39.7	54.1	55.8	55.2	44.0	51.8
Corn meal (fed with clover hay)	88.5	89.0	72.9	80.6	91.7	....	68.7	85.9
Hay, mostly timothy	57.6	57.9	65.2	44.6	63.0	48.0	53.5	54.3
Oats (fed with hay)	69.2	71.3	75.5	....	77.2	30.8	....	63.8
Pea-and-oat hay	64.2	62.5	72.2	54.4	63.7	63.0	58.2	63.2
Oat-and-pea silage	65.5	66.6	74.6	75.0	67.0	61.3	52.4	53.9
Oat-and-vetch hay	55.4	56.2	65.3	62.8	59.0	49.0	44.3	52.1
Oat-and-vetch hay	60.1	60.2	69.5	73.8	62.7	51.5	60.2	56.2
Oat-and-pea hay	58.5	58.5	74.7	64.8	57.6	51.8	59.1	55.4
Hay, mostly timothy	53.4	55.1	53.1	56.1	56.3	53.6	27.8	52.9
Oats (fed with hay)	71.5	72.5	78.9	89.3	77.3	31.2	44.5	67.1
Royal oat feed (fed with hay)	47.3	48.1	69.1	88.2	50.9	33.1	37.4	47.9
Mixed feed (fed with hay)	62.3	64.2	62.6	92.0	70.8	28.3	31.5	70.8
Corn germ (fed with hay)	73.7	74.8	75.4	96.0	71.9	68.2	48.3	77.1

A comparison of determined and calculated heats of combustion, L. H. MERRILL (*Maine Sta. Bul. 67, pp. 169, 170*).—As illustrated by the values obtained with a number of samples of wheat and various milling products, the difference between the determined and calculated fuel value ranged from 0.026 to 0.430 calorie, or nearly 10 per cent of the total determined value. The variations according to the author are intimately connected with the amount of crude fiber present. "If this be true we should expect to find the greatest difference between the determined and calculated heats of combustion in those materials which are especially rich in fiber, such as the coarse fodders and feces of herbivorous animals." The following results bear on this point:

Crude fiber and determined and calculated fuel value of a number of samples of feeding stuffs.

Feeding stuff.	Crude fiber.	Heat of combustion. Determined.	Heat of combustion. Calculated.	Heat of combustion. Difference.
	Per cent.	*Calories.*	*Calories.*	*Calories.*
Oat hay	30.74	4.209	3.719	0.490
Sheep feces from oat hay	33.65	4.290	3.682	.608
Clover silage	33.43	4.184	3.638	.546
Sheep feces from clover silage	32.16	4.379	3.805	.574
Oat-and-pea silage	31.12	4.209	3.984	.225
Sheep feces from oat-and-pea silage	32.88	4.163	3.669	.494

In view of such variations as those noted above, a quantity of crude fiber was prepared from fodder and sheep feces and the heat of

combustion determined in the usual way. The results reduced to a water-free and ash-free basis follow:

Heat of combustion of crude fiber from fodders and feces corresponding to them.

Source of crude fiber.	Heat of combustion.	Source of crude fiber.	Heat of combustion.
	Calories.		*Calories.*
Oat hay	4.405	Feces from oat hay	4.662
Clover silage	4.610	Feces from clover silage	5.215
Oat-and-pea silage	4.667	Feces from oat-and-pea silage	4.820
Average	4.561	Average	4.899

"The crude fiber from the feces had, in these 3 cases, an average determined fuel value over 7 per cent higher than that of the fiber from the corresponding fodders. In other words, the digestible crude fiber had a lower fuel value than that remaining in the feces, and consequently, lower than that of the mixture of carbohydrates included in that term as found in the original fodders."

Experiments on the influence of asparagin and ammonia upon the metabolism of protein in herbivora, O. KELLNER ET AL. (*Ztschr. Biol., 39 (1900), No. 3, pp. 313–376*).—The experiments of other investigators on the effects of asparagin are reviewed in some detail, and 4 series of experiments with sheep are reported. In each series 2 animals were used. In the first period of the first series the ration contained a limited amount of protein. In the second period asparagin was added to practically the same ration. In the second series the ration contained a limited amount of protein in the first period. In the second period ammonium acetate, and in the third asparagin was added to practically the same ration. In the first period of the third and fourth series the ration contained a medium amount of protein, and asparagin was added in the second period. The experimental data are recorded in full. The digestibility of the ration was determined in the different periods, and the balance of income and outgo of nitrogen.

In the first series the balance of income and outgo of sulphur was also determined, and was as follows:

Metabolism of sulphur in a ration with and without asparagin.—Experiments with sheep.

	Sulphur.			
	In food.	In urine.	In feces.	Gain (+), loss (−).
Experiment 1.				
Period 1 (without asparagin):	*Gm.*	*Gm.*	*Gm.*	*Gm.*
Sheep 1	1.807	0.927	0.878	+0.002
Sheep 2	1.781	.957	.834	−.010
Period 2 (with asparagin):				
Sheep 1	1.817	.849	.946	+.022
Sheep 2	1.795	.805	.918	+.072

In some of the experiments the urine was analyzed during the days which elapsed between the different periods. The results of the tests are discussed in detail. The principal conclusion reached is the fol-

lowing: When the ration contained an abundance of protein and was of a character which was suitable for production, asparagin generally exercised no favorable effect as regards gains in protein. When the ration was very deficient in protein, or when a maintenance ration containing little protein was fed and no work was done, asparagin exercised a beneficial effect as regards gains in protein, though the effect was small.

Methods of steer feeding, G. C. WATSON and M. S. MCDOWELL (*Pennsylvania Sta. Bul. 53, pp. 8; Pennsylvania Dept. Agr. Bul. 67, pp. 14*).—This bulletin reports a cooperative experiment made by the station and the Pennsylvania Department of Agriculture. The comparative merits of feeding in pens and stalls was tested with 3 lots of 5 steers each, fed hay and corn stover in addition to a grain ration of corncob meal and wheat bran, 6:1. Lot 1 was fed in a large pen while the steers in lots 2 and 3 were confined in separate stalls. The steers in lot 1 were fed in a common manger and supplied with drinking water by means of an automatic water basin. The same device was used in supplying water to lot 2, while the steers in lot 3 were watered once a day in a yard adjoining the building where they were kept, one of the objects of the test being to study the effects of the different methods of supplying water. The average daily gain of the 3 lots was 12.16, 11.65, and 11.26 lbs., respectively.

"So far as any conclusions are warranted from a single experiment with a few animals, the above results would seem to indicate that dehorned steers can be fed in pens, in the manner practiced with lot 1, with at least as satisfactory results as regards gain as when handled in the more common way, while there is a very considerable saving in the amount of work required to properly care for them. The self-watering device also saved considerable work and possibly effected some economy in the amount of grain consumed per pound of gain, although the unavoidable differences between the lots render this conclusion far from certain."

Sheep-feeding experiments in Nebraska, E. A. BURNETT (*Nebraska Sta. Bul. 66, pp. 16*).—The value of different combinations of corn and other grains with alfalfa hay and prairie hay was studied. The grade lambs used in the test were divided into 3 lots of 16 animals, 4 of 8, and 1 of 20 each. After a preliminary period of 2 weeks on poor quality alfalfa hay and a light ration of shelled corn and oats the test began November 26, and covered 14 weeks. Lots 1, 2, and 3 were fed alfalfa hay and shelled corn, lot 2 receiving oats and lot 3 wheat bran, in addition. Lots 4, 5, 6, and 7 were fed shelled corn and prairie hay, lot 5 receiving linseed meal, lot 6 oats, and lot 7 wheat bran, in addition. All these lots were fed in sheds. For purposes of comparison, lot 8 was fed in an open yard, the same ration as lot 3. The gains ranged from 19 lbs. per lamb in the case of lots 6 and 7 to 34 lbs. in lot 8; the cost of a pound of gain from 2.2 cts. in lot 1 to 3 cts. in lots 5, 6, and 7. The greatest profit per sheep ($2.05) was obtained with lot 1; the least ($1.30) with lot 7.

"All the lambs were fed at a large profit notwithstanding [the] high original cost of 5 cts. per pound delivered at the farm. The alfalfa fed lambs consumed 1.34 lbs. of alfalfa hay and 1 lb. of grain per day as against 0.88 lb. of prairie hay and 0.89 lb. of grain consumed by the prairie hay fed lambs. The alfalfa fed lambs made 52 per cent greater gains than the lambs fed prairie hay with corn and the same grain ration. The lambs fed prairie hay with corn and 16 per cent of oil meal made 26 per cent larger gains than the lots fed prairie hay with a grain ration of shelled corn. or shelled corn with 25 per cent of bran or oats added. In these experiments the addition of bran or oats to the corn in the grain ration did not increase the gains, unless possibly in the case of the 20 lambs fed outside on alfalfa and corn with 25 per cent bran."

Roots and other succulent foods for swine, C. S. PLUMB (*Indiana Sta. Bul. 82, pp. 93-105*).—The value of succulent materials for the winter feeding of pigs is discussed and tests briefly reported on the use of sugar beets, artichokes and purslane for this purpose. When sugar beets were added to a ration of corn meal and shorts 1:2 a lot containing 4 pigs made an average daily gain of 3.89 lbs. during 98 days in the winter. Four similar pigs fed the same ration without beets made an average daily gain of 4.52 lbs. The cost of a pound of gain in the 2 cases was 3.2 and 2.93 cts., respectively. The author believes that the succulent foods have a beneficial influence on health which is not brought out by the results of the test.

To learn the value of artichokes, 4 sows were pastured on a small field planted with this crop for 2 weeks, being fed in addition corn meal and shorts (57.5 lbs. of each). The sows consumed practically all the artichoke tubers, the total gain in weight of the 4 animals being 27 lbs. The author believes better gains would have resulted on a larger field of artichokes. The feeding value of purslane was tested with 2 sows weighing not far from 160 lbs. each. In a period of 21 days they gained on an average of 18.8 lbs., at a cost of 2.2 cts. per pound. The ration consisted of shorts and hominy meal 1:1, with purslane *ad libitum*. About 9.25 lbs. of the latter was eaten per pig daily. Purslane "was not eaten with the relish that was to be expected; yet the pigs did very well while receiving it, making fair daily gains."

Bread and bread making at the Paris Exposition, H. W. WILEY (*Forum, 30 (1900), No. 3, pp. 303-309*).—The Schweitzer system of combined milling and baking is described.

Beans, peas, and other legumes as foods, MARY H. ABEL (*U. S. Dept. Agr. Farmers' Bul. 121, pp. 32, figs. 10*).—The composition, nutritive value, and digestibility of beans of different varieties, peas, lentils, peanuts, and some other legumes which are less common are treated of, as well as the place of legumes in the diet, the comparative value of a number of animal and vegetable foods, and similar topics. The bulletin is a summary of the available literature on the subject and also gives the results of practical experience and many experiments, some of which were undertaken in connection with the present work.

On the bacteriology of canned goods, with a detailed account of bacteria detected in sour corn, S. C. PRESCOTT (*Science, n. ser., 11 (1900), No. 273, p. 442*).—In a paper read before the Society of American Bacteriologists, 1899, investigations

were reported upon the bacteria present in cans of corn which had become spoiled and "swelled." The cause of the trouble was found to be the presence of certain species of bacilli which resisted the temperature used in canning the corn. The same bacilli were found upon the fresh corn and husks.

Food requirements in winter and summer in temperate climates, K. E. RANKE (*Ztschr. Biol., 40 (1900), No. 3, pp. 288–323, dgms. 11*).—Experimental investigations are reported in which the composition of food was determined as well as the amount of water consumed, and that excreted in the urine and feces, in winter and summer. The author's deductions follow: Above 16° C. there is no diminution in the amount of food required corresponding to the temperature. Physiologically active temperatures, which must exceed 20°, diminish markedly the appetite and therefore the food consumed, an effect which pertains more to pathology than to physiology. If large amounts are eaten contrary to the demands of the appetite, the pathological conditions become more marked.

Second report on dietaries for hospitals for the insane in the State of New York, W. O. ATWATER (*Reprint from Ann. Rpt. New York State Com. Lunacy, 11 (1898–99), pp. 190–566*).—Results of a large number of dietary studies of different groups of patients and employees in 2 of the New York State hospitals are reported. The work is discussed and some general deductions are drawn.

A manual of personal hygiene, W. L. PYLE (*Philadelphia: W. B. Saunders & Co., 1900, pp. 344, figs. 69*).—This volume contains chapters on different hygienic topics contributed by a number of writers, that on hygiene of the digestive apparatus, being by C. G. Stockton.

Inspection of concentrated commercial feeding stuffs during 1900, W. H. JORDAN and C. G. JENTER (*New York State Sta. Bul. 176, pp. 36*).—Under the provisions of the State law regulating the sale of feeding stuffs, the protein and fat content of a number of concentrated feeds was determined. These included cotton-seed meal, oil meal, gluten meal and feed, calf meal, malt sprouts, dried brewers' grains, cereal food by-products, hominy feed, chop meal, sugar-corn feed, corn bran, boiled beef and bone, bone meal, beef scrap and meat meal, and a number of mixed proprietary feeds for stock and poultry.

Analyses of commercial feeding stuffs, J. L. HILLS, C. H. JONES, and B. O. WHITE (*Vermont Sta. Bul. 82, pp. 59–79*).—In carrying out the provisions of the State law regarding the inspection of commercial feeding stuffs, analyses are reported of 375 samples collected in the spring of 1900, including cotton-seed meal, linseed-oil meal, flax meal, gluten meal, gluten feed, cereal food by-products (*i. e.*, oat feed and corn and oat feeds), corn and oats, wheat bran, wheat middlings, mixed wheat feeds, corn-and-oat chop feeds, hominy feed, provenders, calf and poultry feeds, dairy feed, glucose bran, corn bran, barley bran, germ-oil meal, oil-cake germ meal, malted barley meal, malted corn meal, sifted corn meal, corn kernels, corn meal, potato feed, and ground oats.

The formation of mustard oil in rape-seed cake and its harmful effects, B. SJOLLEMA (*Landw. Vers. Stat., 54 (1900), No. 3–4, pp. 311–318*).—Experiments on the poisonous properties of mustard oil and its formation in rape-seed cake are reported, as well as of the quantitative determination of mustard oil and the way of rendering cake containing it harmless.

The formation of glycogen when galactose is fed, E. WEINLAND (*Ztschr. Biol., 40 (1900), No. 3, pp. 374–385*).—Experimental investigations are reported.

Principles and practices of stock feeding, J. L. HILLS (*Vermont Sta. Bul. 81, pp. 56*).—A popular summary discussing the principles of animal nutrition, quoting tables of feeding standards, the composition and digestibility of feeding materials, etc.

Cattle rearing in Egypt, C. M. BRUCE (*Jour. Khedir. Agr. Soc. and School Agr., 2 (1900), No. 4, pp. 176–181*).—A general discussion, with especial reference to local conditions.

Feeding experiment with bullocks (*Bd. Agr. [London], Rpt. Agr. Education and Research, 1899–1900, pp. 42–44*).—A feeding experiment at the University College of North Wales to compare the value of maize meal and barley meal is briefly reported. As regards gains in weight, the rations tested were equally satisfactory. As regards the cost of food, there was a slight advantage in favor of the maize meal.

Feeding experiments, E. R. LLOYD (*Mississippi Sta. Rpt. 1900, pp. 20–34*).—The comparative value of corn, cotton seed, and cotton-seed meal; of cotton-seed hulls and cotton-seed meal; cooked and raw cotton seed; and peavine hay, Johnson grass hay, shredded corn and shredded sorghum, was studied. Twenty steers, divided into lots of 2 animals each, were used for these tests, which in every case covered 2 periods of 30 days each. According to the author, 1 lb. of cotton-seed meal was found to be equivalent to 1.81 lbs. of cotton seed, 1.67 lbs. of corn-and-cob meal, or 1.69 lbs. of cooked cotton seed. If cooked cotton seed is taken as a standard, 1 lb. is equivalent to 1.09 lbs. of raw cotton seed, 0.98 lb. of corn-and-cob meal, or 0.60 lb. of cotton-seed meal. One pound of peavine hay was found to be equivalent to 0.92 lb. of Johnson grass hay, 1.38 lbs. of shredded corn, or 1.78 lbs. of shredded sorghum.

Sheep-breeding experiments, J. R. CAMPBELL (*Bul. Yorkshire Col., Leeds, and East and West Ridings Joint Agr. Council, 1900, No. 13, pp. 8, dgm. 1*).—The results of breeding experiments with Lincoln and North Country ewes and Lincoln, Oxford, Hampshire, Shropshire, and Suffolk rams are reported.

Poultry foods and feeding, J. J. McCUE (*Agr. Gaz. New South Wales, 11 (1900), No. 9, pp. 770–779, fig. 1*).—A general discussion and a report of feeding tests with hens to compare dried blood, ox liver, and cut green bone when supplementing a ration of grain and green food. Both as regards egg production and financial returns, the lot having dried blood gave the best results.

Live stock; poultry, J. G. LEE (*Louisiana Stas. Bul. 62, 2. ser., pp. 447–453*).—Brief notes on the cattle, sheep, hogs, and poultry kept at the station and on chickens hatched with an incubator.

Index relating to animal industry, 1837 to 1898, G. F. THOMPSON (*U. S. Dept. Agr., Division of Publications Bul. 5, pp. 676*).—It is the purpose of this bibliography to include all literature relating to animal industry which has appeared in the publications of the United States Department of Agriculture since its inception in 1837, with the exception of the articles in the Experiment Station Record and Insect Life.

DAIRY FARMING—DAIRYING.

Sugar-beet pulp as a food for cows, H. H. WING and L. ANDERSON (*New York Cornell Bul. 183, pp. 16, dgms. 2*).—Sugar-beet pulp is described and an analysis of it given. Two feeding experiments are reported. The first was made with 5 cows and lasted 11 weeks, and the second was made with 6 cows and lasted 10 weeks. In the first test the same quantities of sugar-beet pulp and corn silage were fed to individual cows in alternate periods. A uniform grain ration was fed in addition. The cows were given more hay when fed pulp than when fed silage. In the second test more pulp was fed than silage, the quantities of hay and grain fed in addition being constant throughout. The results are given in detail in tables and diagrams, and the following conclusions are drawn:

"The cows, as a rule, ate beet pulp readily and consumed from 50 to 100 lbs. per day, according to size, in addition to the usual feed of 8 lbs. of grain and 6 to 12 lbs. of hay.

"The dry matter in beet pulp proved to be of equal value, pound for pound, with the dry matter in corn silage.

"The milk-producing value of beet pulp as it comes from the beet-sugar factory is about one-half that of corn silage.

"Beet pulp is especially valuable as a succulent food, and where no other such food is obtainable it may prove of greater comparative value than is given above."

The liability of the total solids of milk to change with age and its effect in the control of market milk, A. REINSCH and H. LÜHRIG (*Ztschr. Untersuch. Nahr. u. Genussmtl., 3 (1900), No. 8, pp. 521–531*).—From the examination of a considerable number of samples of milk when fresh and when 2 or 3 days old, it was found that the total solids diminished slightly with age, but that up to the time of souring the specific gravity did not change; hence the gravimetric result for solids in milk several days old would not agree with the result calculated by Fleischmann's formula, and if the gravimetric result alone were relied upon injustice might be done. Determination of the solids-not-fat is believed to be a more reliable basis for judging of the purity of milk, as this remains practically unchanged. Not until over 3 days after the sample has curdled does the specific gravity of the serum change sufficiently to make it unreliable.

Studies of the market milk of Helsingfors with special reference to its bacteria content, O. VON HELLENS (*Inaug. Diss., Helsingfors, 1899, pp. 80; abs. in Centbl. Bakt. u. Par., 2. Abt., 6 (1900), No. 8, p. 261*).—In summer the bacteria content ranged from 20,000 to 34,300,000 and averaged 474,500 per cubic centimeter; in winter the range was from 70,000 to 18,630,000, the average being 2,111,000 per cubic centimeter. There appeared to be a relation between the bacteria content and the dirt content of milk, although these did not vary regularly. A lower fat content was usually accompanied by a higher bacteria content. To a certain extent the acidity of the milk varied with its bacteria content.

The high germ content of the Helsingfors milk is believed to be due to lack of care in transporting the milk as well as in its production. Approximately one-third of the samples examined contained virulent tubercle bacilli. In 43 out of 57 samples other pathogenic bacteria were found, indicating that a large proportion of the Helsingfors milk contained two or more pathogenic germs.

Preservatives in dairy produce, G. S. THOMSON (*Jour. Agr. and Ind., South Australia, 3 (1900), No. 12, pp. 969–981*).—The use of boric acid and formalin in preserving milk is discussed. A table gives the results of a test of the relative keeping qualities of milk heated to 212 and to 185° F. for 10 minutes, raw milk, milk inoculated with germs of sewage water, and milk similarly inoculated but preserved with boric acid. Experiments are reported in detail in which milk preserved with boric acid was compared with unpreserved milk. Determinations were made of the acidity and specific gravity of the milk at different stages, and of the boric acid in the separator milk and

slime, and in the cream, butter, and buttermilk. Notes are given on the scoring and keeping qualities of the butter. The conclusions drawn from the tests follow:

"One and one-half tablespoonfuls of preservative, containing 82.5 per cent boracic acid, and added to 15 gal. of milk, showed a rise of 0.11 per cent acid in the milk at the end of 38 hours. In a similar quantity of milk, without a preservative, the percentage of acid rose 0.36 in the same number of hours. At the expiry of the 36 hours the preserved milk was faintly acid to taste, while the unpreserved milk was very acid.

"The percentage of acid and the specific gravity of the preserved milk were found to be lower at the top of the milk supply, when compared with the bottom, and proportionately lower than the unpreserved milk.

"Boracic acid gives to milk a liquefying property in the presence of a high percentage of lactic acid, similar with milk after sterilization by heat.

"Milk preserved with boracic acid may slowly rise in the percentage of acid, but it may suddenly increase to a high percentage in an abnormally short time.

"There accompanied the preserved milk, separator milk, and cream a faint bitterness which was not noted in the unpreserved samples.

"The boracic acid added to the milk was principally expelled in the separator milk in the process of separation.

"[Cream to which] 80 gm. of preservative was added . . . showed a rise of 0.08 per cent at the end of 69½ hours, while the unpreserved cream gave a rise of 0.23 per cent acid in the same number of hours.

"The boracic acid added to the cream was to a large extent removed in the buttermilk and washing water. . . .

"Milk preserved with boracic acid and the cream again preserved with additional acid will produce sweet unsalted butter of a low keeping quality, quickly affected with rancidity and bitterness.

"A pink mold will flourish in the presence of boracic acid in butter, when both the milk and cream have been preserved and when no salt has been added to the butter. . . .

"Bitterness accompanied the butter manufactured from preserved milk and cream when no salt was used in the butter, and the bitterness became exceedingly strong after a period of keeping. Butter with the salt and additional boracic acid did not develop the pronounced bitterness.

"The best keeping butter in the test proved to be the sample to which preservative was added to the milk, cream, and again to the butter, but the butter was salted at the rate of 3½ per cent."

Composition of butter made in the Netherlands and conditions which control the changes in composition, J. J. L. Van Rijn (*Leyden, pp. 12*).—The study was undertaken because at certain seasons butter made in the Netherlands was rejected by the official English chemists as adulterated with "margarine or some other fat than butter fat." The English chemists based their conclusions upon the low percentage of soluble and insoluble fatty acids, while in the Netherlands the amount of volatile fatty acids present is considered the better criterion. The volatile fatty acids bear a nearly constant relation to the soluble fatty acids, being 89 to 95 per cent of the latter. The object of the study was to collect evidence to show that during the fall months the amount of volatile and of soluble fatty acids in the butter

made in the Netherlands is less than that which the English chemists accept as the minimum.

Samples of butter that had been churned under the supervision of the collector were taken weekly from 11 dairies and 13 creameries. These samples were tested, and it was found that in the late fall, shortly before the cattle were stabled for the winter, the amount of volatile fatty acids in the butter was much less than normal. Soon after the cows were stabled the amount of volatile fatty acid increased. It is thought that the warmth and comfort of the cows, due to stabling, accounts for the improvement in the butter, and that the practical remedy is the earlier stabling of the cows.—H. M. PIETERS.

The influence of certain conditions in churning on the amount of water in butter, J. B. WEEMS and F. W. BOUSKA (*Iowa Sta. Bul. 52, pp. 43–53*).—Investigations were made to determine the existence and effectiveness of some of the principles governing the proportion of water in butter. The relation of the size and shape of the granules to the water content of unworked butter and the removal of water by working are discussed.

In the experiments reported cream was ripened, cooled, and divided into 2 equal lots. Both lots in each test were churned under the same conditions in order to secure uniformity in the size and shape of granules. In each of 7 comparative tests one lot was washed with cold water and the other lot with comparatively warm water. The softer butter resulting from the use of the warmer water in washing contained the most water. In 3 comparisons where the granules were of the same size differences of 21, 24, and 32° F. in the temperature of the wash water made corresponding differences in the water content of the butter of 2.57, 2.66, and 2.30 per cent, respectively. In one test washing coarse granular butter with water at 45° was compared with washing fine granular butter with water at 70°. The water content of the butter made in the 2 ways was respectively 14.07 and 17.50 per cent. Several tests are also reported which showed that the extent of working influenced the water content of the butter.

These principles were observed in actual practice in preparing butter for export to England. The cream was churned at a low temperature and the churning continued until the granules were as large as peas. The butter was washed with cold wash water and given 2 partial workings. Of 32 samples analyzed, 24 contained less than 12 per cent of water.

The result of working on the water content of butter, J. SIEDEL and HESSE (*Milch Ztg., 29 (1900), Nos. 42, pp. 659, 660; 43, pp. 675, 676*).—Butter from the same dairy was divided into 3 portions and treated as follows: (1) worked only a little and salted, (2) salted and left in the moist dairy as usual, and (3) salted and worked until it appeared to be very dry. The same amount of salt was added to each

lot. The butter was left until another day and worked once or twice until the water content appeared normal. The results were variable, but the average water content of the third portion averaged slightly higher.

The results also indicate that butter worked moderately when hard tends to hold on to its water content. To the old rule that soft butter should not be worked might be added that hard butter should not be worked until it becomes soft as it will become too poor in water.

The chemical action of molds on butter, J. HANUŠ and A. STOCKY (*Ztschr. Untersuch. Nahr. u. Genussmtl., 3 (1900), No. 9, pp. 606–614*).—In preliminary experiments *Mucor racemosus* was found to grow best on butter, and this was used in subsequent experiments. In the latter it was found that the principal change was a cleavage of the glycerids, resulting in an increased acidity of the butter. From the fact that enzyms have been found in many molds the theory is suggested that the mold grows first on the nutrients it finds in the butter, *i. e.*, the carbohydrates and proteids, and when these are exhausted, elaborates the enzyms in large quantity which are capable of cleaving butter fat, and then feeds upon the glycerin liberated. The fungi appeared to be able to assimilate only such of the fatty acids liberated as are of low molecular weight.

Cream testing, C. H. ECKLES (*Iowa Sta. Bul. 52, pp. 31–42*).—The author discusses testing cream by the Babcock method, reporting several investigations in this connection and giving suggestions for avoiding common sources of error.

The influence of the thickness of sweet and sour cream upon the amount adhering to the pipette in measuring was tested. Cream was measured with a 17.6 cc. pipette when sweet and again after 24 hours. In one measurement in each case the pipette was blown out as in testing milk, and in one the adhering cream was rinsed out and added to the measured quantity. The results are given in the following table:

Comparison of two methods of measuring cream for the Babcock test.

Cream.	Pipette blown out.	Pipette rinsed out.	Gain by rinsing.
	Per cent.	*Per cent.*	*Per cent.*
Fresh from separator	19.6	20	0.4
Sour, acidity 0.72 per cent	19.6	20.5	.9
Fresh from separator	29.8	30.4	.6
Sour, acidity 0.64 per cent	29.5	30.9	1.4
Fresh from separator	41.5	42.5	1
Sour, acidity 0.54 per cent	41	43.5	2.1

"From these figures it is evident no change in amount measured could be made to remove this varying error. This error can be removed easily and completely by rinsing out the pipette with about one-third of its volume of warm water and adding this to the measured cream."

Determinations were made of the error resulting from measuring the cream due to specific gravity, and a table designed for practical use is given showing corrections for different readings. Tests by measure of cream 5 hours and 24 hours after separation gave practically the same results. Determinations of the specific gravity of cream containing from 10 to 50 per cent of fat are given, and the method employed is described.

The source of separator slime, P. VIETH and M. SIEGFELD (*Molk. Ztg., 14 (1900), Nos. 42, pp. 725, 726; 43, pp. 746-748*).—Analyses of separator slime made by various persons are quoted, together with the results of the researches of the writers. It was found that the milk richest in fat gave a greater amount of slime than poor milk, but the amount was not proportional to the fat content. The milk poorest in fat showed in the slime a smaller percentage of water and fat and a higher percentage of protein and ash.

From the results of their researches the authors conclude that, while not the only source, the serum capsule or envelope of the fat globule makes up the larger part of separator slime.

A study of butter increasers, J. B. WEEMS and F. W. BOUSKA (*Iowa Sta. Bul. 52, pp. 54-59*).—Two methods or recipes for increasing the yield of butter were investigated. Both are quoted, as well as a circular advertising one of them. The directions were followed in each case and the products obtained were analyzed. One method, in which sweet cream, sour cream, and butter were churned together, gave a product containing 41.54 per cent of water, 53.04 per cent of fat, 2.96 per cent of casein, and 2.46 per cent of ash. The butter scored 72½; it had no grain, and became soft and greasy a few minutes after taking from the refrigerator. The other method, in which sweet milk, butter, and a butter increaser consisting principally of alum and pepsin were used, gave a product containing 49.64 per cent of water, 41.46 per cent of fat, 5.06 per cent of casein, and 3.84 per cent of ash. It scored only 50, and besides having no body was of unsatisfactory flavor. "The butter increaser had curdled the milk and also spoiled the flavor." Two samples of a similar product received from firms in Chicago showed 59.61 and 42.76 per cent of water and 21.31 and 44.92 per cent of fat, respectively. One had 11.72 per cent of casein. Another process recently patented in England is described.

Dairy husbandry, J. S. MOORE (*Mississippi Sta. Rpt. 1900, pp. 25-33*).—Notes are given on the feeding and care of the station herd of pure-bred Jersey cows. A monthly summary of the yield of milk, average fat content of milk, yield of butter, and the cost of feed for each of the 8 cows in the herd is given in tables. The average production per cow for the year was 5,192 lbs. of milk containing 5.52 per cent of fat and yielding 334.4 lbs. of butter. The cost of feed was $29.57.

An experiment lasting 12 weeks was made to test the effect of feeding grain to cows on pasture. The herd was divided into 2 lots, both of which were fed grain during

the first 6 weeks of the test. During the last 6 weeks only one lot received grain. The results were considered as showing practically no difference in the yield of milk due to feeding grain to cows on good pasture.

The relative values of mangels and swedes as food for dairy cattle, W. P. J. ALLSEBROOK (*Jour. British Dairy Farmers' Assoc., 15 (1900), No. 3, pp. 163–168*).—A study of the relative cost of production, feeding value, and value of the residue. Tables of analyses are compiled. From most points of view the mangel is considered the more valuable crop to the dairy farmer.

The use of the cactus Opuntia ficus indica in a ration for milch cows in Sardinia, G. SOTGIA (*Staz. Sper. Agr. Ital., 33 (1900), p. 113; abs. in Centbl. Agr. Chem., 29 (1900), No. 12, pp. 803, 804*).—An analysis showing the feeding value of the plant is given and the results of its use as a part of a ration for milch cows are reported.

The effect of gestation in cows upon the mineral matter of milk, especially phosphoric acid and lime, A. KORT (*L'Ing. Agr. Gembloux, 9 (1899), pp. 453–475; abs. Centbl. Agr. Chem., 29 (1900), No. 10, pp. 667, 668*).—It was found that the percentage of phosphoric acid and lime decreased more or less regularly up to the time of calving, while the colostrum was rich in ash. When lactation was greatest the percentage of phosphoric acid and lime was lowest, the amount increasing and remaining at the normal up to the middle portion of the next gestation period. The food had no influence upon either the mineral content of the milk or of the urine of cows.

The handling of milk samples, M. SIEGFELD (*Molk. Ztg., 14 (1900), No. 46, pp. 797–799*).—Rules for taking and keeping milk samples are given.

Bacteriology of milk, B. H. STONE (*Amer. Cheesemaker, 15 (1901), No. 179, pp. 1, 2*).—A paper read at the Vermont Dairymen's Association by the State bacteriologist.

Improvements in cream testing, A. C. BEBEE (*Chicago Dairy Produce, 7 (1901), No. 71, p. 22*).—Conclusions reached by daily experiments long conducted, upon the influence of speed, temperature, and time whirled and the scaling and marking of bottles in the Babcock test.

Tyrogen, a pure culture of ripening bacteria of Emmenthaler cheese, W. WINKLER (*Molk. Ztg., 14 (1900), No. 47, pp. 817, 818*).—A pure culture of *Bacillus nobilis*. The advantages in using a pure culture of this bacillus are said to be improvement in the form and construction of the cheese, the imparting of a uniform Emmenthaler taste and aroma, and the shortening of the process of manufacture.

The use of the acidimeter in cheese making, MARGARET KNOWLES (*Jour. British Dairy Farmers' Assoc., 15 (1900), No. 1, pp. 37–40*).—A popular article describing the method or making the acid test of milk, and stating its advantages over the rennet and hot-iron tests.

VETERINARY SCIENCE AND PRACTICE.

Communications from the official veterinary sanitary reports for the year 1898, J. ESSER and W. SCHÜTZ (*Arch. Wiss. u. Prakt. Thierh., 26 (1900), Nos. 4–5, pp. 336–388*).—In one locality a number of outbreaks of anthrax occurred after eating beet chips. The beets had been grown in a territory known to be infected with anthrax. In another locality several head of cattle were affected with anthrax after feeding with green corn which had been grown in an anthrax territory. Outbreaks of anthrax were also caused by dusting stalls with soil taken from the vicinity of anthrax carcasses, and using gravel from a similar

locality about sheep corrals. A few cases of spontaneous recovery from the apoplectic form of anthrax are recorded. Preventive vaccination against blackleg gave good results in 600 young cattle. A detailed report is made on the prevalence of rabies. In the case of a horse which was bitten by a rabid dog, an incubative period of 21 months was noted. Notes are also given on foot-and-mouth disease, pneumonia, and glanders. Foth's mallein was used in the study of an epidemic of glanders. Two horses which gave no reaction to the first injection manifested symptoms of glanders 17 days later, and of 8 horses which gave a typical reaction, only 2 proved to be infected with glanders.

Brief accounts are given on the prevalence of tuberculosis and hog cholera. The average cost of applying the Lorenz vaccination method for hog cholera was about 12 cts. The vaccination had no injurious effect upon the hogs. In a number of localities where hog cholera had caused annual losses of considerable severity, this disease was apparently eradicated by vaccination. Brief notes are also given on cowpox, actinomycosis, mineral and plant poisoning, organic diseases, and meat inspection.

Texas fever in the Argentine Republic, LIGNIÈRES (*Rec. Méd. Vét., Paris, 8. ser., 7 (1900), No. 22, pp. 735–774, figs. 3*).—In Argentina and Uruguay this disease is known by the name of "tristeza." The author presents a critical review of the literature of the subject and describes in detail the symptoms and post-mortem conditions in the mild and acute cases of the disease. During the author's studies, especial attention was given to alterations in the blood and urine of diseased animals. From these investigations it was found that the blood parasite of Texas fever exerts an influence especially upon the hemoglobin and albumin of the blood, destroying a considerable part of the former with fixation of iron, and rendering both the hemoglobin and albumin more soluble. The quantity of sugar preformed in the blood remains about stationary, while the glucosids and the proteid materials undergo a rapid diminution. It was found also that the blood of diseased animals when taken during the acute stage of the disease, was extremely irritant and toxic. Such blood when injected into the marginal vein of the ear of a rabbit in doses of from 3 to 5 cc., killed the animal within a few seconds. The same quantity of blood injected into the peritoneum of the guinea pig produced death within a few minutes. The symptoms of death in such cases were those caused by caustic fluids. After the hemoglobinuric stage had passed, the blood remained light colored for a long time and slowly recovered its normal properties. In such cases the blood of diseased animals, although pale when in the vessels, assumes a reddish color on exposure to the air. This fact was observed when the destruction of the red corpuscles was relatively slight. A few hours before death it was noted that the blood had nearly the color of coffee.

The author made a detailed study of alterations in the structure of the red blood corpuscles during the various stages of the disease. Notes are also given on the diminution of the number of red corpuscles.

The whole subject of the development of *Pyrosoma bigeminum* is reviewed in detail by the author. It is stated that all pyriform hematozoa assume a round form at one stage, and that this is a natural and not merely an accidental form in the development of the parasite. The round form was found in the organism in considerable abundance, especially when the disease began to decline. In no case did the round form become metamorphosed directly into a pyriform hematozoön.

The author succeeded in following the development of the blood parasite of Texas fever in artificial cultures, and in connection with the known fact of the existence of both a mild and an acute form of the disease, raises the question as to whether these two forms of the disease may be due to two forms of the blood parasite.

Parturient apoplexy under Schmidt's treatment, J. H. TENNENT (*Jour. Comp. Med. and Vet. Arch., 21 (1900), No. 5, pp. 286-292*).—The author applied Schmidt's treatment in the following manner: A quart of boiling water was poured into a clean vessel and when cooled to a temperature of 100° F., 1 dram of formalin and 1½ drams of potassium iodid were added and the whole was gently shaken. The cows which were to be treated were thoroughly milked and the udder and teats were washed with antiseptic solutions. Eight ounces of the solution of formalin and potassium iodid in water were injected into each quarter of the udder through the milk ducts of the teat. Treatment which accompanied the use of Schmidt's treatment consisted in the removal of feces from the rectum and the use of a catheter in cases where urine was retained over 12 hours. No medicines were given by the mouth unless the patient was able to stand. Detailed notes are given on the history and treatment of 15 cases of parturient apoplexy, of which 13 recovered and the author believes the other 2 cows would have recovered but for the interference of the owners. Some of the worst cases made the most speedy recovery. Considerable difficulty was experienced in keeping up the heart's action, but this was successfully accomplished by the use of nux vomica and whisky.

A preliminary report upon forage poisoning in horses (so-called cerebro-spinal meningitis), L. PEARSON (*Jour. Comp. Med. and Vet. Arch., 21 (1900), No. 11, pp. 654-657*).—The author investigated an outbreak of disease among 7 horses of which 5 died. The symptoms were those of paralysis, which affected the throat first and gradually extended to other parts of the body. Two of the 7 horses which were removed from the barn ultimately recovered. A silo had been opened about a week before the first cases were noticed, and as the silage was moldy on top it was suspected of causing the trouble. The author therefore conducted 2 feeding experiments with this silage. Between October 30 and November 2, 1900, a horse was given approximately

½ bu. of the silage mixed with oats and bran. On November 3 there was a well marked paralysis of the throat and a slight elevation of temperature. The general muscular weakness progressed until the horse was unable to stand. Death occurred November 4. Another horse was given 4 gal. of water which had percolated through a bushel of silage on November 5, 3 gal. on November 6, and on November 8 he was given 6 qt. of silage. Similar symptoms were developed and on November 10 the animal was found dead. The author believes that cerebro-spinal meningitis is an inappropriate term for this disease and proposes the name forage poisoning.

The action of certain somnifacients on the horse, E. S. Muir (*Jour. Comp. Med. and Vet. Arch., 21 (1900), Nos. 4, pp. 193–198; 5, pp. 278–282*).—The author conducted a number of experiments for the purpose of determining the action of sulphate of morphia, normal liquid *Cannabis indica*, and chloral hydrate crystals upon the horse. From his experiments it was evident that sulphate of morphia produces more or less delirium in the horse, while occasionally a slight delirium followed the administration of large doses of *Cannabis indica*. The pupils become widely dilated after large doses of morphia, while *Cannabis indica* has no action in that direction. The only pronounced action of chloral was somnolence, accompanied by a muscular weakness. The author gave 60 cc. of *Cannabis indica* intravenously without producing any alarming symptoms, and it is believed that with a horse of 1,100 lbs. weight in good condition, it would be quite safe to inject into the jugular vein 1 gm. sulphate of morphia, 50 cc. of *Cannabis indica*, or from 25 to 30 gm. of chloral hydrate.

Experimental studies of rabies, Vera Solomon (*Centbl. Bakt. u. Par., 1. Abt., 28 (1900), No. 3, pp. 70–79, figs. 3*).—The author conducted experiments in devising new methods for the experimental diagnosis of rabies and in determining the action of the bile upon the virus of rabies. The virulent materials for experimental inoculations which have thus far been applied include the saliva of man or of a rabid animal, the salivary glands, kidneys, pancreas, milk, and central nerve substance, especially the medulla oblongata. The different methods thus far employed for experimental diagnosis are intracutaneous injection, subcutaneous injection, infection of the mucous membrane of the nose, inoculation of the serous membranes, inoculation of the chambers of the eye, subdural injection, inoculation of the nervus medianus, intravenous inoculation, intracerebral inoculation, and inoculation in the lumbar portion of the spinal cord.

The author experimented with these different remedies, and especially upon different methods of intracerebral inoculation. The method devised by Leclainche and Morel is considered by the author more satisfactory than that of Pasteur and Roux for the reason that it is cheaper, more easy of application, and more certain in its results.

Experiments were also tried in experimental diagnosis of rabies by means of direct inoculation through the occipital foramen. This method gave good results and is considered satisfactory and unobjectionable, except for possible accident which might result from the sudden movement of the animal.

The author undertook a series of experiments on rabbits for the purpose of determining the effect of bile upon rabies virus. The active virus and bile were taken from rabbits just dead of rabies, mixed in equal parts, and inoculated in the subdural region. The results of these experiments indicate that pathological bile renders the incubation period of rabies longer, and in certain cases neutralizes the virus, while normal bile has a similar though much weaker action.

Hemorrhagic septicæmia of ducks and chickens, A. RABIEAUX (*Jour. Med. Vet. et Zootech., 5. ser., 4 (1900), pp. 129–140, fig. 1*).—An epizootic occurrence of this disease was observed in November, 1899, among a number of poultry establishments in one neighborhood. The ducks and chickens were receiving at the time as food grain and potatoes. The outbreak of the disease was sudden, 36 cases having developed within 14 hours, of which 18 were among ducks and 18 among chickens. Sixteen of the ducks and 14 of the chickens succumbed to the disease. An autopsy made upon some of the dead birds showed little or no pericardial exudate. There were numerous confluent ecchymoses upon the heart and the mucous membrane of the small intestine was thickened and much congested. The contents of the intestine were bloody. The clinical symptoms were not constant nor well marked. As a rule, the progress of the disease was so rapid that the symptoms were not observed. In some instances the author observed a staggering gait in the birds shortly before death. The pathogenic organism of this disease was an ovoid bacterium which resembled that of chicken cholera, but was slightly larger. The organism was found in abundance in the blood, liver, spleen, bone marrow, and intestinal contents. When examined fresh, the organism appeared to be a coccus or diplococcus with active brownian movements. It was readily stained with Kühne blue or carbolized thionin. After being stained, the organism appeared in the form of a bacillus with rounded ends.

The organism is aerobic and can be cultivated easily upon all the ordinary media at a temperature of from 35 to 38° C., except upon potato. In artificial media and in contact with the air, an attenuation of the organism progresses rapidly with a complete loss of its virulence in from 15 to 30 days. The organism has only a slight resisting power to desiccation or to the ordinary antiseptic reagents. It is very susceptible to heat and is destroyed by exposure for 6 minutes to a temperature of 55 to 56° C. Cultures of the organism in bouillon heated to 60° C. and then filtered lose all their virulence, but the filtrate con-

tains a toxin which produces an elevation of temperature and other symptoms when inoculated in rabbits and other laboratory animals. The toxin appears to be exceedingly active, especially when inoculated into the jugular vein.

The disease can be transmitted experimentally either with pure cultures, with isolated bacteria, or with material collected from animals dead of this disease. In ducks and chickens the disease can be produced by ingestion of pure cultures or virulent products mixed with food. Death occurs in from 30 to 48 hours after eating such material. The post-mortem appearances in these cases are exactly the same as in cases of death resulting from the disease when acquired under natural conditions. The rabbit was found to be most susceptible and the guinea pig most resistant to inoculations with this organism. By passing the organism repeatedly through a series of experimental animals belonging to the same species, its virulence is increased for this species. By passing this organism through rabbits, it was observed that its virulence was decidedly increased for the rabbit, but was not especially modified as regards the pigeon, and was attenuated as regards its action upon guinea pigs. Repeated inoculation of sterilized cultures into rabbits and guinea pigs conferred immunity upon these animals to the disease.

The author believes that this disease should not be confounded with chicken cholera. It differs from chicken cholera, especially in the susceptibility of different animals to the organism. The pathogenic agent of the disease is an ovoid bacterium which seems to have acquired an unusually high virulence.

The epidemiology of malaria from recent observations, A. Celli (*Centbl. Bakt. u. Par., 1. Abt., 28 (1900), No. 17, pp. 530–535*).—The author found that the distribution of malaria-bearing mosquitoes was more extensive than that of the disease. The various species of mosquitoes may be carried in different ways to considerable heights on mountain sides or into other localities where malaria does not prevail. Brief notes are given on the distribution of *Anopheles claviger*, *A. pictus*, *A. pseudopictus*, and *A. bifurcatus*.

Entozoa, A. E. Shipley (*Fauna Hawaiiensis, 2 (1900), No. 4, pp. 427–446, pls. 2*).—The author gives brief notes on the parasitic worms found in the domestic animals and man in the Sandwich Islands.

A text-book of special pathology and therapy of domestic animals, F. Friedberger and E. Fröhner (*Lehrbuch der speciellen Pathologie und Therapie der Hausthiere. Stuttgart: Ferdinand Enke, 1900, vol. 2, 5. ed., pp. 756*).—This volume contains chapters on the following subjects: Diseases of the nasal cavity; diseases of the larynx; diseases of the trachea, bronchial tubes; lung diseases; diseases of the pleura; chronic constitutional diseases, and contagious diseases in general.

Bacteriological and pathological microscopy, T. Kitt (*Bacterienkunde und pathologische Mikroskopie für Thierarzte und Studirende der Thiermedicin. Vienna: M. Perles, 1899, 3. ed., pp. 525, pls. 2, figs. 155*).—This volume contains an account of technical methods for the study of pathogenic bacteria; preparation of sections of pathological tissue; methods of inoculation of experimental animals; methods of

studying parasitic insects, mites, and worms, and a general account of the bacteria which cause the common infectious diseases.

The histology of the spleen during the course of infectious diseases, DOMINICI (*Arch. Med. Exper. et Anat. Path., Paris, 1. ser., 12 (1900), No. 6, pp. 733–768, pls. 3*).—The author conducted experiments for the purpose of determining the rôle of and anatomical changes in the spleen during an infection of septicæmia caused by the bacillus of Eberth. It was found that the spleen under such conditions fulfills the function of producing leucocytes and giant phagocytes. During the process of the disease the spleen underwent a myeloid transformation.

The germicide and agglutinating properties of serums immunized against Bacillus pyocyaneus, P. MÜLLER (*Centbl. Bakt. u. Par., 1. Abt., 28 (1900), No. 18, pp. 577–587*).—From experiments made outside of the animal organism, the author concludes that in the absence of oxygen the germicide power of the normal serum of guinea pigs toward *B. pyocyaneus* is greater than in the presence of oxygen. Nonvirulent bacteria were much checked in their growth by a normal serum, while virulent forms were not especially affected. Serums which were immune to *B. pyocyaneus* exhibited a stronger germicide power under aerobic conditions than normal serum.

Agglutination of the Trypanosoma of the rat upon different kinds of serum, LAVERAN and NESNIL (*Compt. Rend. Soc. Biol. Paris, 52 (1900), No. 34, pp. 939–942*).—The author tested the action of the serum of different animals in agglutinating Trypanosoma. Rabbits, dogs, sheep, horses, chickens, pigeons, and rats were used for this purpose. The sera of all these animals, except that of the rat, agglutinated the Trypanosoma within a period of an hour, when mixed with an equal volume of defibrinated blood containing these parasites. The Trypanosoma was not immobilized before it became agglutinated.

Intravenous injection of potassium iodid and protargol, PETER (*Berlin. Tierärztl. Wchnschr., 1900, No. 33, pp. 385–387*).—The author experimented with intravenous injections of protargol in the treatment of a number of cases of morbus maculosus. It was found that a single dose of 100 gm. of a 75 per cent aqueous solution of protargol could be injected into the blood of cattle and horses without injurious effects, and that a noticeable therapeutic effect was produced by this substance in the treatment of malignant catarrh of cattle. Potassium iodid was used in combination with proteids. The results of the author's experiments indicate that this substance may be safely used in intravenous injections. An experiment with sodium iodid combined with proteids on the other hand demonstrated that this substance is not suitable for intravenous injections, since serious disturbances were produced in the red blood corpuscles which resulted in a hæmoglobinuria.

Treatment of tetanus by fright, KISSUTH (*Berlin. Tierärztl. Wchnschr., 1900, No. 45, p. 532*).—Two cases of undoubted tetanus were treated by fright produced by firing a gun in the stall in which the affected horses stood. The gun was fired at the time when the muscular contraction was at its height, and had the effect of producing a complete muscular relaxation, after which the animals were able to eat and drink without much difficulty. One case recovered completely after a period of 14 days, while recovery in the other case was slower.

Report of veterinarian, J. C. ROBERT (*Mississippi Sta. Rpt. 1900, pp. 36–40*).—The work of the year on Texas fever consisted chiefly in an attempt to determine the value of blood inoculation in preventing the appearance of disease in southern cattle and the discovery of some efficient curative agent. Twenty-five young northern cattle were inoculated with blood from tick-infested native cattle. The amount of blood used varied from $1\frac{1}{2}$ to 5 cc. and was used in some cases as drawn and in other cases defibrinated. Symptoms of inoculation fever appeared within 10 days. None of the animals died and they were turned out with native cattle about 5 weeks after the second inoculation. Southern cattle frequently die of Texas fever. Some cattle

appear to escape tick infestation while young, and when they subsequently become infested with large numbers of ticks they succumb to the virulent form of the disease. The only treatment from which the author obtained any favorable results consisted in administering 1 lb. of Epsom salts and hypodermic doses of 30 grains of quinine every 3 hours. Brief notes are given on the occurrence of blackleg, anthrax, glanders, and tuberculosis in the State.

List of plants of known or suspected poisonous properties which occur within the State, E. V. Wilcox (*Montana Sta. Bul. 22, pp. 51–53*).—A list is given of 14 species of plants which are known to the writer as being poisonous, or which have been suspected by stock growers as being injurious to stock. Of the species mentioned the purple and tall larkspurs, aconite, lupine, death camass, nightshade, and water hemlock are known to have caused the death of a number of animals, and loco weeds are suspected as being injurious. The author investigated a number of cases of poison reputed to be due to certain plants, but upon investigation found that the evidence was either of a very unsubstantial nature, or the suspected plant was in no way connected with the death of the animals.

Lupines as plants poisonous to stock, E. V. Wilcox (*Montana Sta. Bul. 22, pp. 37–45*).—Brief notes are given on a number of cases of poisoning from lupine which were observed in Montana. In 1 case 100 out of 200 bucks fed upon lupine hay died within a few hours after feeding. In another case a considerable loss of sheep was suffered from allowing them to eat ripe lupine upon the range. After autumn snowstorms in 1898 the loss of sheep from eating lupine upon the range in Montana amounted to 2,000, 1,150 of which were from 1 band. A few cases of lupine poisoning in horses are also recorded. The most severe losses from lupine poisoning have been due to eating these plants in the form of hay, a large quantity of which is annually cut in the State. The poisoning in all cases seemed to be due to eating the ripe or nearly ripe seed, which would appear to contain the poisonous principles in greater abundance than other parts of the plant. A brief bibliography is also given.

Cattle poisoning by the tall larkspur, E. V. Wilcox (*Montana Sta. Bul. 22, pp. 45–47*).—Notes are given on the appearance and distribution of *Delphinium glaucum* in Montana. An outbreak of cattle poisoning which occurred in the Gallatin Basin, and which resulted in the death of 40 cattle, was investigated. It was found that the poisoning was due to the species of larkspur just mentioned, and that this plant had been apparently eaten in unusual quantities, on account of the fact that other green forage was covered by a recent fall of snow.

Poisoning of stock by the water hemlock, E. V. Wilcox (*Montana Sta. Bul. 22, p. 48*).—Brief notes on cases of poisoning from this plant in man, sheep, and cattle. In cattle the symptoms were severe pain, accompanied by cerebral excitement and spasms. In 1 case the animal died within 15 minutes after the appearance of the first symptoms.

The poisoning of cattle by smutty oat hay, E. V. Wilcox (*Montana Sta. Bul. 22, p. 51*).—During the winter of 1898 a dairyman lost 12 cows in feeding smutty oat hay. The oats had become so badly smutted that they were cut for hay rather than grain. Out of 30 cows which received 1 feed of the smutty oat hay 12 died within 18 hours after feeding, with symptoms of gastric disturbances and cerebral excitement.

Ergotism in horses, E. V. Wilcox (*Montana Sta. Bul. 22, pp. 49, 50*).—Ergot is reported as very abundant on a considerable variety of native grasses in the State. A number of cases of poisoning observed in horses are believed to be forms of ergotism. The symptoms were a gradual paralysis beginning with the muscles of the throat; horses were soon unable to swallow, and later became unable to stand, and died of general paralysis. Death occurred in the majority of cases within from 6 to 12 hours. In 2 cases recovery took place after the administration of strychnin hypodermically and whisky by the mouth

Report of the veterinary service and meat inspection in Norway for the year 1898 (*pp. 126*).—This report contains a general account of the work of the veterinary department, together with special accounts of anthrax, catarrhal fever, blackleg, hog cholera, swine plague, tuberculosis, milk fever, and other diseases. The regulations for meat inspection in different cities are also given, together with notes on the frequency of various diseases found during such inspection.

The diseases of cattle, D. MONFALLET (*Bol. Soc. Nac. Agr.* [*Lima*], *5. ser., 1900, No. 1, pp. 35–53*).—The author gives a general account of the various forms, etiological symptoms and treatment of pneumonia and pleurisy in cattle.

Actinomycosis in cattle, C. J. REAKES (*Veterinarian, 73* (*1900*), *No. 871, pp. 357–359*).—The author presents an account of an unusual outbreak of actinomycosis in Ellsmere.

Anthrax, KISSUTH (*Berlin. Tierärztl. Wchnschr., 1900, No 46, p. 543*).—Among 60 head of cattle, which were shipped to Gurhau from eastern Prussia, 4 developed acute cases of anthrax within a few hours after being turned out to pasture, and 3 died. The author believes that anthrax spores were taken on the food, and that the action was more rapid and more severe on account of the empty condition of the digestive tract.

A variety of anthrax bacillus with short forms and without spores, C. PHISALIX (*Compt. Rend. Acad. Sci. Paris, 131* (*1900*), *No. 7, pp. 424–427*).—A number of forms of this organism have already been noted and have received different names. These different forms are found under different conditions or in the blood of different animals. In the dog the anthrax bacillus undergoes important modifications, the first of which are changes in its functions and virulence. The bacillus multiplies rapidly by budding and the formation of short rods similar to micrococcus. The name *Bacillus anthracis brevigemmans* is proposed for this form.

Agglutination of the tubercle bacillus by tuberculous serums, P. COURMONT (*Compt. Rend. Soc. Biol. Paris, 52* (*1900*), *No. 36, pp. 1000–1002*).—The author obtained positive results in experimental tests of such serums from man and animals, and believes that this method constitutes a rapid and certain procedure for diagnosing tuberculosis. Experiments with nontuberculous discharges of diphtheritic or septicæmic nature gave negative results.

An experiment in the transmission of tuberculosis, E. PERRONCITO (*Gior. R. Soc. Accad. Vet. Ital., 49* (*1900*), *No. 45, pp. 1057, 1058*).—The author fed 2 pigs with milk to which had been added fresh tuberculous material of bovine origin. Generalized cases of tuberculosis were developed in both experimental animals.

Tuberculosis in New Zealand, J. A. GILRUTH (*Veterinarian, 73* (*1900*), *No. 870, pp. 359–370*).—Notes on 1,500 tuberculin tests, chiefly in dairy cows. The author discusses general infection, the means by which the disease is spread, the method of extermination, and regulations for controlling the prevalence of the disease. The author believes that tuberculin has no curative action upon tuberculosis.

Tuberculosis in pheasants in Wangamui, S. H. DREW (*Trans. and Proc. New Zealand Inst., 32* (*1899*), *pp. 54–56*).—The Wellington Acclimatization Society imported a number of *Phasianus reevesii*. The birds were inclosed for a time after arrival in a pen near a museum. After some time one of the birds died, and on making a post-mortem examination it was found that various vital organs were badly infected with tuberculosis. Similar experience was had by other societies in importing these birds. It remains doubtful how the birds became infected, since they were watered with rain water and were fed no meat, liver, or milk. The only other animals which could enter the inclosure were rats, and it is suggested that the infection may have been carried by them.

On the behavior of the tubercle bacillus in frogs, O. LUBARSCH (*Centbl. Bakt. u. Par., 1. Abt., 28* (*1900*), *Nos. 14–15, pp. 421–430*).—This is mainly a controversial article, but from additional experiments made by the author it is concluded that

tubercle bacilli introduced into the lymph cavity of a frog are carried from this position into the internal organs and may be found in such locations for weeks or even months. At the point of injection small granulating tubercles are not infrequently developed. Tubercle bacilli which have remained for weeks in the body of a frog do not produce tubercles when inoculated into guinea pigs.

Parturient apoplexy. A discussion of milk fever, W. A. THOMAS (*Jour. Comp. Med. and Vet. Arch., 21 (1900), No. 11, pp. 671–675*).—In order to secure information regarding the methods of treatment of practicing veterinarians and their success with cases of parturient apoplexy, the author sent out a circular letter of inquiry to the practicing veterinarians of Nebraska, from whom 11 replies were received. Of the veterinarians who replied to the circular 9 had given medicine by way of the mouth and 3 had adopted the Schmidt treatment. The success of treatment was not striking in any case. The author objects to the use of the term parturient paresis and inclines to the belief that the primary lesions of the disease are in the brain.

Tumor formations in certain of the domestic animals, J. A. GILRUTH (*Veterinarian, 73 (1900), No. 870, pp. 291–301, figs. 6*).—Degenerate and calcified hydatids were present in the lungs and liver of a vast majority of cattle and sheep inspected in the abattoirs of New Zealand. Notes are given for the purpose of reaching a differential diagnosis between such nodules and those of tuberculosis. A similar discussion is given of nodules of the peritoneal surface of the intestines, calcareous nodules in the flanks of sheep, epithelioma, and granuloma.

Swine fever, J. A. GILRUTH (*Veterinarian, 73 (1900), No. 872, pp. 419–439, figs. 4*).—From a series of observations and experiments made by the author it is concluded that pulmonary and pleural lesions frequently occur along with or independently of the so-called characteristic intestinal lesions of swine fever. The results obtained indicate that it is doubtful whether hog cholera and swine plague are 2 distinct diseases.

Mallein in the treatment of glanders, J. MCCALL (*Veterinarian, 73 (1900), No. 870, pp. 383–387*).—Detailed notes are given on 4 horses injected with mallein. Cultures made from tubercles found on post-mortem examination gave negative results, while the reaction to mallein was well marked, and the usual anatomical lesions of glanders were found.

The nature of "horse sickness," RICKMANN (*Berlin. Tierärztl. Wchnschr., 1900, No. 29, pp. 337, 338*).—The author inoculated himself and also a horse with 1 cc. of virulent blood from a case of this disease. After 11 days the horse died of typical symptoms of the disease, while the author was entirely unaffected by the operation, although he was susceptible to malaria. The author believes that although this disease is very similar to malaria it is not identical with it.

Diseases caused by horse worms, and their treatment, F. V. THEOBALD (*Jour. Southeast Agr. Col. Wye, 1900, No. 9, pp. 49–66, figs. 7*).—Biological and economic notes are given on the common species of tapeworms and nematodes, which are found parasitic in the horse.

Dourine and its pathogenic organism, G. SCHNEIDER and M. BUFFARD (*Rec. Med. Vet., Paris, 8. ser., 7 (1900), No. 3, pp. 81–105, figs. 20*).—The authors made extended investigations on dourine in horses with regard to methods of prevention, diagnosis, and treatment, and a special study of the etiology of the disease. The pathogenic organism is considered to be a species of Trypanosoma. The authors were able to produce the disease experimentally in horses, dogs, rabbits, rats, mice, and the jackass. It was found that the organism could be transmitted by a hypodermic injection, by contact with the mucous membrane of the vagina, and by inoculation under the cerebral membranes.

Detailed notes are given on the period of incubation of the disease in different

animals and upon the symptoms and course of the disease. The pathogenic organism is described and figured.

A diagnosis of rabies, H. VALÉE (*Rev. Vet. Toulouse, 25 (1900), No. 12, pp. 763-768*).—A brief critical discussion of the various methods which have been proposed for diagnosing rabies before and after death.

Diagnosis of rabies upon an histological examination of nerve centers of animals which have died prematurely, C. FRANÇA (*Compt. Rend. Soc. Biol. Paris, 52 (1900), No. 36, pp. 985-987*).—From microscopic post-mortem examinations made by the author it is concluded that rabid animals which die prematurely do not always exhibit the rabic nodules in the ganglia. More frequently it was found that such elements exist only in an extra capsular position in a greater or less quantity. Lesions in the bulb were more striking and were formed earlier than those in the ganglia.

Rabies in dogs, I. GUERRICABEITIA (*Gac. Med. Vet., 24 (1900), No. 174, pp. 513-516*).—Brief notes by way of diagnoisis of this disease.

Common diseases of the fowls—their control and treatment, F. D. CHESTER (*Delaware Sta. Bul. 47, pp. 30, figs. 12*).—This bulletin contains a general account of the common diseases of poultry. The author discusses the symptoms, etiology, and treatment of gapes, simple catarrh, roup, pip, noninfectious gastroenteritis, fowl cholera, asthenia, blackhead, various diseases of the reproductive organs, vertigo, epilepsy, scaly leg, depluming scabies, favus, bumblefoot, tuberculosis, and infectious leukæmia.

Roup of chickens, E. V. WILCOX (*Montana Sta. Bul. 22, pp. 27-29*).—A brief description of the disease and an account of the remedies usually adopted against this disease are given. During an outbreak of roup in Montana diphtheritic membranes were removed from the mouth and larynx and a direct application of lunar caustic was then made to the raw surface thus exposed. The mouth cavity and eyes were then washed with a solution of nitrate of silver in the proportion of 8 grains to the ounce of water. In some cases 1 application was successful, while in others 2 or 3 were required.

The internal chicken mite, E. V. WILCOX (*Montana Sta. Bul. 22, pp. 30-36*).—A brief description of *Cytodites nudus* is given and the literature relating to this species is discussed. While studying this mite in Montana it was found in 5 chickens which were evidently suffering from some serious disease. In 1 case a large number of intestinal nematodes were present and in the other 4 cases the chickens were affected with nodular tæniasis. Two perfectly healthy chickens were found to be thoroughly infested with cytodites, and in these cases, as well as in the others, no lesions were traceable to the action of cytodites. Thorough disinfection of poultry houses is recommended as a preventive measure against this mite.

Intestinal helminthiasis of fowls, RAILLIET (*Rec. Med. Vet. Paris, 8. ser., 7 (1900), No. 2, pp. 36-43*).—The author studied an outbreak of helminthiasis among fowls which was caused by *Heterakis perspicillum*, *H. vesicularis*, *Davainea cesticillus*, and *D. proglottina*. A serious mortality resulted from the presence of these parasitic worms. The remedies which were tried included calomel, areca nut, santonin, ether extract of male fern, and a mixture of the last two.

Calomel in doses of 2 to 4 cg. gave no result. Areca nut in doses varying from 2 to 6 gm. was ineffective. Santonin, even in doses of 28 mg., produced no appreciable effect. One pullet in a period of 3 weeks received 70 mg. of santonin and 50 cg. of the ether extract of male fern without any appreciable effect on the intestinal parasites.

Forceps for holding pigs during inoculation, BURY (*Berlin. Tierärztl. Wchnschr., 1900, No. 33, p. 388*).—A brief description of a form of forceps which proved to be convenient for this purpose.

AGRICULTURAL ENGINEERING.

The use of water in irrigation (*U. S. Dept. Agr., Office of Experiment Stations Bul. 86, pp. 253, pls. 50, figs. 18*).—This is a report of investigations made in 1899 under the supervision of E. Mead, expert in charge of irrigation investigations of this Department, and C. T. Johnston, assistant, in accordance with the act of Congress authorizing irrigation investigations by the Department. The report contains papers discussing the results of the year's investigations by E. Mead; tables for use in measuring water, and diagrams showing use in different localities, by C. T. Johnston; and reports and discussions of irrigation investigations in different localities by special agents W. M. Reed, New Mexico; W. H. Code, Arizona; W. Irving, California; O. V. P. Stout, Nebraska; T. Berry, Colorado; C. T. Johnston, Wyoming; S. Fortier, Montana; R. C. Gemmell and G. L. Swendsen, Utah; and D. W. Ross, Idaho. The bulletin explains the methods in use in the arid States in the distribution and use of water in irrigation and gives a large number of measurements made to determine the duty of water and the losses by seepage and evaporation from canals, and discusses the methods by which the water supply may be more effectively and economically utilized in the production of crops. The results show a very variable, but wasteful, use of water in irrigation under present methods and enormous losses from canals and reservoirs by seepage and evaporation. Three tables given in the bulletin afford a very striking illustration of the extent of these losses. These tables show the amount of water (1) flowing into large canals at their headgates, (2) taken out by small canals and laterals, and (3) actually reaching the fields. The difference in results of the 3 measurements shows the approximate loss of water in transit. The following table gives the averages of the 3 classes of measurements:

Measurements at different places in an irrigation system, showing losses in transit.

		Depth.
Measured at the head of large canals	feet	5.63
Measured at the heads of small canals and laterals	do	2.40
Measured at the margins of fields where used	do	1.29

"A comparison of the duties secured under many of the canals where measurements were made last year leads to the belief that it will be possible through improved methods to double the average duty now obtained, so that the quantity now required for one acre will serve to irrigate two. If this can be accomplished it will relieve the scarcity under many canals, put an end to many controversies growing out of such scarcity, lessen the expense per acre for water, and immensely increase the productive and taxable resources of the arid States."

Irrigation in New Jersey, E. B. VOORHEES (*U. S. Dept. Agr., Office of Experiment Stations Bul. 87, pp. 40, figs. 5*).—This bulletin discusses the need of irrigation in New Jersey and other States with similar rainfall conditions; reports the results of experiments at the

station and elsewhere in New Jersey during 1899 to determine whether supplemental irrigation is profitable under such conditions; and gives descriptions and statements of cost of a number of small irrigation plants in New Jersey. In the experiments at the station the increase in yield of small fruits due to irrigation was as follows: Blackberries, 1,038 qts. per acre, worth $93.42; raspberries, 329 qts. per acre, worth $32.90; and currants, 311 qts. per acre, worth $31.10. The results of similar experiments in other parts of the State with a variety of crops confirm those obtained at the station.

"So far as rainfall conditions are concerned, New Jersey belongs to the so-called humid region, and may be considered typical of the whole eastern half of the United States. Judging from the results reported in this bulletin, there seems to be no doubt that irrigation for fruits and market gardens, even in regions where rainfall is normally abundant, is a profitable undertaking."

Storage of water on Gila River, J. B. LIPPINCOTT (*Water Supply and Irrig. Papers, U. S. Geol. Survey, No. 33, pp. 98, pls. 33*).—This is a report on investigations undertaken in 1896 and 1899 with a view to finding means of affording relief to the Pima, Papago, and Maricopa Indians of the Gila River Reservation, who have been deprived of an adequate supply of water for irrigation by diversion of the supply at points in the Gila River watershed above the reservation. The report gives some account of these Indians and of their use of water for irrigation purposes; reviews the causes of the shortage of water and the steps taken to correct it; discusses the water supply of the Gila River basin—precipitation, flow of streams, evaporation, etc.; and records the results of investigation of storage reservoir sites at the Buttes, the Dikes, Riverside, San Carlos, Guthrie, and on Queen Creek, with remarks on irrigable land under the various proposed reservoirs, the distribution of canals, and the organization of irrigation districts. The bulletin also contains a paper by E. Duryee recording the results of investigations on cement, undertaken "(1) to ascertain whether by unusually fine grinding of the cement its strength can be appreciably enhanced and the quantity correspondingly reduced; (2) whether it is feasible to use the rocks found at the dam sites for making a sand cement; (3) whether Portland cement can be economically made at these sites;" the object being to lessen the cost of Portland cement in constructing the dams.

As a result of the investigations the author advises the construction of the San Carlos dam and makes various recommendations regarding further investigations and the management of the stored water and the lands to be irrigated.

The conclusions of the author have been verified by J. D. Schuyler, whose general conclusions and recommendations are incorporated in the report.

Geology and water resources of a portion of southeastern South Dakota, J. E. TODD (*Water Supply and Irrigation Papers, U. S. Geol. Survey, No. 34, pp. 34, pls. 5, maps 5*).—This paper gives the results of investigations of the geology, surface waters, and underground waters of the region named.

Operations at river stations, 1899 (*Water Supply and Irrigation Papers, U. S. Geol. Survey, Nos. 35–39, pp. 471*).—These bulletins give "descriptions of the river stations maintained during 1899 by the United States Geological Survey, together with tables of the average daily height of water, results of measurements of discharge, and rating tables constructed from the latter and applicable in general for the calendar year." For reports of similar data for 1898, see E. S. R., 11, p. 1094.

Pennsylvania road statistics, J. HAMILTON (*Pennsylvania Dept. Agr. Bul. 66, pp. 97*).—This bulletin gives the text of the road law passed by the State legislature in 1897, and tabular statements of the mileage of roads in each township, together with the tax levy, proximity of stone suitable for ballast, and other data.

STATISTICS—MISCELLANEOUS.

Thirteenth Annual Report of Kansas Station, 1900 (*Kansas Sta. Rpt. 1900, pp. XXIV–163*).—The report proper contains the organization list of the station, a financial statement for the fiscal year ended June 30, 1900, a general review of the work of the different departments, and a subject list of station publications issued since the organization of the station. Reprints of bulletins 90–98 of the station on the following subjects are appended: Alfalfa in eastern Kansas (E. S. R., 11, p. 1037), swine plague (E. S. R., 12, p. 190), soy beans—a new drought-resisting crop (E. S. R., 12, p. 142), Kafir corn (E. S. R., 12, p. 332), sugar beets, 1899 (E. S. R., 12, p. 334), station publications (E. S. R., 12, p. 399), fattening hogs with drought-resisting crops (E. S. R., 12, p. 375), soil inoculation for soy beans (E. S. R., 12, p. 333), skim milk calves (E. S. R., 12, p. 472), and scale insects upon Kansas grasses (E. S. R., 12, p. 466).

Thirteenth Annual Report of Maryland Station, 1900 (*Maryland Sta. Rpt. 1900, pp. X+161*).—The report proper contains the organization list of the station, a brief review of the work and publications of the station, a meteorological summary for 1899, and a financial statement for the fiscal year ended June 30, 1900. Bulletins 63–67 of the station on the following subjects are reprinted: Experiments in feeding pigs for the production of pork (E. S. R., 12, p. 174); a study of the cause of mottled butter (E. S. R., 12, p. 182); some important insecticides, fungicides, and apparatus for their application (E. S. R., 12, pp. 572, 581); the occurrence and composition of lime in Maryland, together with a report of the results of experiments in testing its use in agriculture (E. S. R., 12, p. 624); and the culture and handling of tobacco in Maryland (E. S. R., 12, p. 637).

Thirteenth Annual Report of Mississippi Station, 1900 (*Mississippi Sta. Rpt. 1900, pp. 42*).—This includes the organization list of the station, a financial statement for the fiscal year ended June 30, 1900, a general report on station work during the year by the director, and more detailed reports by the heads of departments, parts of which are noted elsewhere. Reprints of Bulletins 60 and 62–64 of the station dealing with the following subjects are appended: Value of cotton seed to the farmer (E. S. R., 11, p. 1069); feeding cotton seed, cotton-seed meal, and corn to dairy cows (E. S. R., 11, pp. 1079, 1080); feeding cotton seed, cotton-seed meal, and corn to beef steers (E. S. R., 11, pp. 1022, 1068); cost of wintering the beef herd (E. S. R., 11, p. 1084); feeding cotton seed to hogs (E. S. R., 11, p. 1072); varieties of cotton (E. S., R., 12, p. 844); inoculation of soils (E. S. R., 12, p. 843); and inspection and analyses of fertilizers (E. S. R., 12, p. 841).

Sixth Annual Report of Montana Station, 1899 (*Montana Sta. Bul. 24, pp. 115–152*).—This includes the organization list of the station, a financial statement for

the fiscal year ended June 30, 1899, a report of the director on the work and publications of the station during the year, and departmental reports, two of which are noted elsewhere.

Experiment Station Work—XVI (*U. S. Dept. Agr. Farmers' Bul. 122, pp. 32, figs. 5*).—This number contains articles on the following subjects: Liming grass lands early plowing for wheat, grafting grape cuttings, culture and uses of olives, nuts as food, coffee substitutes, the working of a pure-food law, selling eggs by weight, relation of feed to the flavor of eggs, feeding moldy corn, and preparation of unfermented grape juice.

Press Bulletins Nos. 35 to 70 (*Kansas Sta. Bul. 99, pp. 56*).—This contains reprints of weekly press bulletins issued by the station from April 5, 1899, to June 26, 1900. The articles are based largely on the results of experiments at the station. Following are the subjects treated: Dysentery in calves and other young animals; experiments with swine plague or hog cholera; Kafir corn, alfalfa hay, and soy beans for pork; what is a digestion experiment; skim milk calves; orchard cultivation; a digestion experiment with alfalfa hay; to rid the house of flies, selection of seed wheat; the profitable strawberry bed; early plowing and moisture conservation; soy beans; awnless brome grass; the Kansas Experiment Station; the horn-fly trap experiment; infectious abortion in cattle; alfalfa in eastern Kansas; some nitrogenous forage plants; experiments with sugar beets to 1899 and 1900; Kafir corn; plant breeding by bud selection; digestion experiments with Kafir-corn stover and Kafir-corn meal; protective inoculation against blackleg in cattle; questions about forage plants; how to test the vitality of garden seeds; gophers and crab grass *v.* alfalfa; salsify, or oyster plant; tame grasses for Kansas; *Bromus inermis;* prevention of grain smuts; horn fly remedies; causes of failure in spraying; the cultivated catalpas; the Buffalo tree hopper; the cultivated millets; and botanical notes on wheat and spelt.

The agriculture of the future. Hydraulic agriculture, A. RONNA (*Jour. Agr. Prat., 1900, II, No. 51, pp. 897–901; 1901, I, Nos. 1, p. 21; 2, pp. 50–53*).—By hydraulic agriculture, as discussed in this article, is meant the use of water not only as a motive power, but also for irrigation and as a carrier of fertilizing material to the soil (warping) in connection with intercultural cover crops which conserve and increase the nitrogen supply of the soil.

Agriculture in Switzerland in the nineteenth century, E. CHUARD (*La Suisse au dix-neuvième siècle. Extrait: L'Agriculture. Lausanne: F. Payot; Berne: Schmid & Francke, 1901, pp. 75, figs. 31*).—A historical sketch of Swiss agriculture during the last century with reference to agricultural practices, agricultural societies, schools, and experiment stations, and other agricultural subjects.

Agriculture in the Grand Duchy of Luxemburg, J. J. WAGNER (*Bul. Gesell. Förder. Wiss., Ackerb. u. Künste, Unter-Elsass, 34 (1900), No. 9, pp. 305–312*).—A brief popular article on agricultural conditions in Luxemburg, and discussing in a general way agricultural education and the work of agricultural societies.

Agricultural statistics for New Zealand (*New Zealand Dept. Agr. Rpt. 1900, pp. 347–371*).—Statistics for 1899–1900 on imports and exports. A supplement containing general agricultural statistics is attached.

NOTES.

ALABAMA STATION.—J. G. Gilchrist, of the board of control, died recently at his home in Hope Hull, Ala. His successor has not yet been selected. J. Q. Burton has resigned as assistant chemist to accept a position in the Georgia State Laboratory, and Charles W. Nixon has been appointed in his place.

CALIFORNIA UNIVERSITY AND STATION.—The State legislature has provided an annual appropriation of $250,000 for the university for the next two years, in addition to its regular income. A department of irrigation has been established in the university, and Elwood Mead, irrigation expert of this Department, has been elected professor of the institutions and practice of irrigation. Professor Mead will deliver a course of lectures at the university, extending over six weeks, on the institutions of irrigation. His new position will not necessitate his relinquishing the charge of the irrigation investigations of the Department, as an assistant professor will be provided.

CONNECTICUT STATE STATION.—Clifford Langley resigned March 1 to accept a position in New York City. He has been succeeded by I. F. Harris.

PURDUE UNIVERSITY AND STATION.—The State legislature has appropriated $60,000 for a new agricultural building, with $10,000 a year for two years for maintenance and equipment of the same. Ex-President Benjamin Harrison, who died March 13, was a trustee of the university and station. Within the past twenty-five months President Smart and two of the most prominent trustees of Purdue have died.

IOWA COLLEGE AND STATION.—Homer C. Price, of the University of Ohio, has been elected to the chair of horticulture and forestry in the college and horticulturist of the station. F. R. Marshall has been appointed assistant in animal husbandry, to succeed G. M. Rommel.

KANSAS STATION.—A. S. Hitchcock, botanist of the college and station, has resigned to accept the position of assistant agrostologist in this Department. He entered upon his duties March 1.

NORTH DAKOTA COLLEGE.—The legislature has granted the college one-fifth mill on all taxable property, thus doing away with the necessity for the uncertain biennial appropriation. Plans are being prepared for the completion of the new chemical laboratory and for a science hall, to be built during the present year, and also for a new barn to replace the one recently destroyed by fire.

OHIO STATION.—Clarence W. Waid, B. S., recently assistant horticulturist at the New Hampshire station, has been appointed to the same position at the Ohio station.

SOUTH DAKOTA COLLEGE AND STATION.—The State legislature has provided $40,000 for an engineering and physics building, and $10,000 for a building for work in plant breeding. The fund for the general expenses of the college has been increased, and a law passed affirming the Morrill and Hatch funds to the institution in perpetuity. The appropriation of $1,000 for the experimental work at Highmore was continued. The governor has appointed I. D. Aldrich, of Bigstone, and I. W. Goodner, of Pierre, on the board of regents of education (governing board of the college and station), to succeed H. H. Blair and R. W. Haire.

Wyoming University.—The legislature has appropriated funds for the completion of the Science Hall and to enlarge the campus. The new building will contain the geological museum and preparatory rooms, the botanical and chemical laboratories, and a large lecture room. A central heating plant for all the buildings will be built.

Necrology.—Dr. George T. Fairchild died March 15, 1901, after a lingering illness, at Columbus, Ohio, where he had gone for medical treatment. According to an account of his life in the Kansas Agricultural College *Industrialist*, Dr. Fairchild was born at Brownhelm, Ohio, October 6, 1838, his father being a farmer and teacher. He was educated at Oberlin College, graduating in the classical course in 1862 and in the department of theology in 1865. He was ordained to the ministry in the Congregational Church, but never served as pastor, as he was elected instructor in the Michigan Agricultural College in 1865 and the next year was made professor of English literature, which position he filled until called to the presidency of the Kansas State Agricultural College in December, 1879. He remained at the head of the latter institution for seventeen and a half years, withdrawing at the close of the collegiate year 1897. Under his presidency this college grew steadily in efficiency and in general appreciation, both in the State and among similar institutions. "The attendance grew from year to year, appropriations by the State legislature became more abundant, and the name of the college became a synonym for thorough educational work. During the first year of his connection with the college the attendance was but 276; during the last year it had grown to 734." Dr. Fairchild was prominently identified with the educational associations of this country. He was a life director in the National Educational Association, and took a prominent part in the Association of American Agricultural Colleges and Experiment Stations, of which he was president in 1897. The last four years of his life were comparatively uneventful. After a period of rest, during which he wrote his book on "Rural Wealth and Welfare," he accepted a call to the chair of English literature at Berea College, Kentucky, which position he occupied at the time of his death.

National Bureau of Standards.—The recent act of Congress providing for the establishment of this new bureau calls for a director, physicist, chemist, two assistant physicists or chemists, several laboratory assistants, a secretary, engineer, and mechanician. The appointment of Dr. Samuel W. Stratton, of the University of Chicago, as director, has been announced. Dr. Stratton has been in charge of the Office of Standard Weights and Measures in Washington. The appropriation for the bureau carries $27,140 for salaries, $100,000 toward the erection of a fire-proof laboratory, the entire cost of which is not to exceed $250,000, $25,000 for a site for the laboratory, $10,000 for equipment, and $5,000 for general expenses, making a total of $167,140. A visiting committee of five members, consisting of experts in the various interests involved, but not in the employ of the Government, is provided for. Fees will be charged for the services of the bureau in making comparisons, calibrations, tests of apparatus, or investigations, except those performed for institutions connected with the Federal or State governments. Germany is said to provide $116,000, Great Britain $62,100, and Austria $46,000 annually for the maintenance of similar standardizing bureaus.

Agricultural Education in Germany.—According to a note in the *Gardeners' Chronicle* (29 (1901), No. 734, p. 45), there are at present 241 institutions in Germany giving instruction in agriculture, exclusive of the special schools of horticulture, dairying, and other industries. There are chairs of agriculture and agricultural institutes connected with 12 universities, and in addition 20 schools of agriculture, not including the primary schools, where the education given is of a more elementary character. Traveling teachers also visit remote districts to instruct the peasants and show them the best methods of cultivation, etc.

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EXPERIMENT STATION RECORD.

Editor: E. W. ALLEN, Ph. D., *Assistant Director.*

EDITORIAL DEPARTMENTS.

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Entomology and Veterinary Science—E. V. Wilcox, Ph. D.
Horticulture—C. B. Smith.
With the cooperation of the scientific divisions of the Department and the Abstract Committee of the Association of Official Agricultural Chemists.

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EXPERIMENT STATION RECORD.

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The question of the establishment of experimental farms in connection with the experiment stations is being agitated to considerable extent in Germany. This plan of carrying on a small farm in connection with the station, where field and feeding experiments are conducted on a more or less practical scale, is referred to as the "American system." Several years ago Professor Maercker, of the Halle Station, made a tour of the American stations, and was much impressed with the value of the farm portion of the station equipment as an accessory means of studying certain problems closely related to practice, and of verifying and testing the practical application of laboratory investigations.

The Lauchstädt Experimental Farm, which is connected with the Halle Station, is an outgrowth of Professor Maercker's American trip, and is the only German representative of the so-called American system. This farm was started about five years ago. In addition to its fields and plats, where experiments in culture, fertilizing, and management of field crops are carried on, it has a herd of cattle which are used for feeding and dairy experiments. Several annual reports of its operations have been reviewed in the Record as they appeared. The farm has evidently attracted a good deal of attention in Germany during the few years it has been in operation, and has appealed strongly not only to practical farmers and agriculturists, but to higher officials as well.

As is generally known, the German stations do not have any considerable area of land or conduct what we understand as field experiments, except as they may do so in cooperation with farmers, their culture work being carried on for the most part in vegetation pots or small plats and quite restricted. The same is true of their feeding experiments, which are made with a small number of animals and usually cover only short periods. While their strictly scientific experiments have taught us much regarding the nutrition of animals and the utilization of food, as well as the methods of investigation, their more practical experiments must be regarded as quite inferior in point of method to their research work.

The Lauchstädt Experimental Farm was in a sense a new departure in experiment station work in Germany. Although it has been in

operation so short a time, it has given rise to a popular demand for a number of stations on that plan, which appears to be receiving considerable support from specialists and the press. Last fall Professor von Rümker, of Breslau, published an article in the *Journal für Landwirtschaft*, on the importance of experimental farms in connection with agricultural experiment stations. In this he paid a high tribute to the American stations, and maintained that their German representative at Lauchstädt had abundantly justified its establishment. He thought it should serve as an example to many other German stations, and believed that the establishment of modern experimental farms was a natural demand of the times which promised to mark an epoch in the history of the German experiment stations. He earnestly advocated relieving experiment stations of control work for the most part, and the establishment of experimental farms in connection with a considerable number of stations. He held these farms to be of great advantage to agricultural production, and a potent means for the improvement of agricultural practice.

This suggestion of Professor von Rümker's has not met with universal approval. In a reply to his article, in a late number of *Die landwirtschaftlichen Versuchs-Stationen*, Prof. J. König, the eminent director of the experiment station at Münster, in Westphalia, takes very decided exception to von Rümker's opinion of the value or applicability of the results obtained at such experimental farms. He shows from a review of the history of the German stations that when they were first established they were expected to work out formulas and practical directions for feeding and manuring, and that, accordingly, many of the stations were given considerable tracts of land or had such land under their control. It was found more advantageous for the research, however, to move the stations to towns or cities where educational institutions were located; and he contends that the wisdom of this course has been fully demonstrated, and that the results accomplished do not warrant recommending a return to the old order of things. The experimental farm, he says, furnishes only a mass of experiences from which generalizations can not be made or the true significance measured; and he holds that such experimenting is not scientific and does not furnish practical indications which are of more than local and temporary application. The attempt of the stations to meet the early requirements and prescribe rules for agricultural practice has not been successful for the reason that conditions vary so greatly in different localities and at different times. He even holds that experimental fields are dangerous for such farmers as are inclined to follow results blindly without considering carefully their own conditions. The thing which the German stations stand in most need of, he says, is not a change in their system of operations, but more free time for research. In conclusion, he states as his judgment that experimental farms on the plan of that at Lauchstädt are useful for purposes of instruction at agricultural high schools, but are not necessary for experiment stations, because we lack as yet the necessary

basis for interpreting the results, and this basis can not be worked out in experiments on a large scale where a variety of unknown conditions prevail.

This discussion is interesting to those connected with the stations in this country, where similar experience has been passed through. The earlier stations were patterned very largely after the German stations. Later it was found to be desirable for a number of reasons to have fields and herds connected with the stations. The tendency at first was to go rather to the extreme in this matter, but as experience has been gained and the confidence of the farmers secured, there has been a marked tendency to diminish the areas under cultivation, to give far less prominence to the commercial features of farming, and to combine, as far as practicable, with the farm operated by the agricultural college. Visitors to our stations do not always realize that the farm which they see is not operated entirely by the station, and that the larger portion of it is frequently carried on by the college for use in connection with its instruction, a partnership which in many cases has been mutually helpful.

The Lauchstädt farm is hardly a fair representative of the American station farm as it is carried on to-day, and as many of its experiments have been very practical and very unlike the ordinary work of most of the German stations, it is not surprising that a proposition to increase the number of such farms should meet with considerable disapproval. Our experience, however, has indicated that without maintaining a large and expensive farm, where many of the operations are purely practical, commercial, or merely for demonstration, comparatively small farms conducted on the experimental basis may be made very useful to the stations in their work, and to the farmers in whose interest the work is carried on. As primary means of investigation the experiment station farms have often been overrated. Their greatest usefulness is as secondary, or intermediate, agencies for the reduction of theoretical results of scientific investigation to a practical basis. It is believed that such experimental farms would prove to the advantage of the German stations in much the same way that they have to the stations in this country, especially if they are to give serious attention to improving agricultural practice.

It seems entirely reasonable that the feasibility and the practical application of results of investigations made on a small scale in laboratories, plant houses, experimental stables, or even on field plats, should be determined first by the stations making such investigations. Otherwise the results must be looked upon as largely theoretical, and if made use of at all by farmers are likely to be misleading. As a rule such studies conducted on a farm basis show that many factors not considered in the smaller trials have to be taken into account in actual practice. The latter studies oftentimes call for the exercise of as much scientific acumen and knowledge and more inventive and prac-

tical skill than the laboratory investigations. Take the case of some of the investigations which have been made on the laboratory scale in the preservation of barnyard manure. From the results obtained on a small scale, methods of treatment have been indicated which have not always been found advantageous when put to the test on a large scale, on account of other factors which entered in. Again, the plan of inoculating the soil with micro-organisms for legumes, either with pure cultures or with soil containing these germs, seemed quite simple in theory, but in practice numerous difficulties were encountered which it has required skill and perseverance to overcome. Studies of the availability of fertilizing materials, and the combating of insect pests and plant diseases present similar analogies. The laboratory research frequently does not end the investigation of a subject if any regard is had to its introduction into practice, and without this the result of the investigation is merely a contribution to science and in the case of station work does not accomplish its full purpose.

The American stations have profited greatly by the investigations and researches of the German stations, and to a certain extent have emulated their example. Their greatest success, however, has not been in the field of pure science, but in improving the conditions and practices of the various branches of agriculture; and in doing this they have taken advantage of the agricultural investigations of the world as well as of their own research work and experiments.

Professor König minimizes the importance of this, and is not inclined to give the American stations credit for having conducted any investigations of real value. For he intimates, in reply to von Rümker's praise of the American system of stations, that "magnificently equipped buildings, beautiful photographic reproductions, a large amount of labor, and long series of analyses without deductions" do not mean scientific contributions, and he adds that he knows of no results of American investigations which have or should have influenced the direction of their investigations. Be this as it may, there can be little doubt that through the course which the American stations have pursued they have exerted a greater influence on American agriculture during the time they have been in operation than the German stations have upon the agriculture of that country in the same time, in spite of the far larger number of well-trained and highly educated agriculturists and farm managers in the older country. It is quite certain that if the American stations had confined their operations to laboratories, greenhouses, and small plats, and had conducted their feeding experiments with two or three animals at a time or with the respiration apparatus exclusively, their progress in reaching and benefiting the American farmer would have been exceedingly slow, and they would not have won his confidence to the extent of becoming by common consent his advisers in nearly every branch of farming operations.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

On uniformity in soil analyses, A. D. HALL (*Analyst, 25 (1900), No. 296, pp. 281–291*). —This article gives the recommendations of a committee of the Agricultural Educational Association, consisting of T. S. Dymond, M. J. R. Dunstan, C. M. Luxmoore, T. B. Wood, and A. D. Hall, as well as some of the results obtained by members of the committee in testing the methods proposed and a discussion of them by B. Dyer and others. The recommendations are as follows:

"(1) *Taking sample.*—Under ordinary conditions the sample shall be taken to a depth of 9 in., but in case of shallow soils to such lesser depth as marks a natural line of demarcation. The committee approves of the use of the auger as one method that may be adopted for taking samples. Several cores should be taken and mixed for analysis.

"(2) *Drying.*—The sample shall be air-dried for analysis. The drying may be accelerated by heating to a temperature not exceeding 40° C., but in all cases the soil should be finally left for a day or two, spread in a thin layer, and exposed to the air at the ordinary temperature of the room.

"(3) *Sifting.*—A sieve with round holes, 3 mm. in diameter, shall be used to separate the fine earth for analysis from the stones and gravel. Gentle pressure with a wooden or caoutchouc pestle or other means may be adopted to break up aggregates of clay and silt, but care should be taken not to crush any of the stones or lumps of chalk.

"For determination of the 'available constituents' the 'fine earth' is used without grinding. For the other determinations 100 gm. or more of 'fine earth' is sifted through a woven sieve of 40 meshes to the inch, or a sieve with round holes of 1 mm. in diameter. What is retained by the sieve is ground till it will pass through, and the whole mixed. Perforated zinc, with holes $\frac{1}{8}$ in. and $\frac{1}{25}$ in. diameter, is commercially obtainable, and forms a convenient material for the construction of the two sieves. . . .

"(4) *Determination of moisture.*—The sample is dried in the steam oven to constant weight.

"(5) *Determination of loss on ignition.*—The result shall be so expressed as not to include the carbon dioxid expelled from the carbonates nor the moisture previously determined.

"(6) *Determination of nitrogen.*—Unless otherwise specified, the nitrogen shall be determined by Kjeldahl's method.

"(7) *Determination of carbonate of lime.*—The carbon dioxid evolved on treatment of the fine earth with acid is calculated as carbonate of lime.

"This is regarded as a convenient measure of the 'available basicity' of the soil, without discriminating between carbonates of lime and magnesia.

"(8) *Determination of 'total' mineral constituents.*—The fine earth is boiled with strong hydrochloric acid in an open flask for a short time in order that the acid may

attain constant strength, and digested at the ordinary water bath or steam oven temperature for 40 to 48 hours, the flask being loosely stoppered. In this solution the phosphoric acid and potash are determined, and other mineral constituents as desired. . . .

"(9) *Determination of available phosphoric acid and potash.*—Unless otherwise specified, the method described by Dr. B. Dyer (Jour. Chem. Soc., 1894, Trans., p. 115) shall be followed, the quantities used being 200 gm. unground fine earth and 20 gm. citric acid in 2,000 cc. water, no further addition of citric acid being made.

"(10) *Expression of results.*—Unless otherwise stated, results shall be expressed as percentages calculated on the fine earth in an air-dry state."

As will be seen, the recommendations deal only with those determinations with regard to which there is a general consensus of opinion and do not enter into the questions of interpretation of results nor the details of analytical processes and manipulation.

The detection of lead in potable water, BELLOCQ (*Jour. Pharm. et Chim., 6. ser., 13 (1901), No. 2, pp. 56, 57*).—For this purpose the author makes use of a modification of a reagent described in an earlier article,[1] which contains pure zinc sulphate ($\frac{1}{3}$ saturated solution) 30 cc., soda solution 30 cc., sodium carbonate (saturated solution) 40 cc., the modification consisting of the substitution of ammonia for the soda solution. From 5 to 10 cc. of this reagent is added to 1 to 2 liters of the water and after standing a few hours the supernatant liquid is decanted and the precipitate collected on a filter, dried, carefully detached from the filter, dissolved in warm acetic acid, filtered, and the filtrate tested with potassium chromate for lead.

Some physical and chemical properties of salad oils, G. E. COLBY (*California Sta. Rpt. 1898, pp. 165–169*).—The author has compiled data relative to the index of refraction, specific gravity, thermal degree, viscosity of soap solutions formed from oils, iodin number, saponification value, melting point of fatty acids from oils, and special tests of American and European salad oils. The data relative to the thermal degree and viscosity of soap solutions formed from pure olive oils and a number of other oils are tabulated. The results are summarized and the value of the different determinations for the detection of adulterants is discussed.

"Pure olive oil of California production, according to the data at hand, has an index of refraction at 15.5° C. of 1.4689 to 1.4717, a specific gravity at 15.5° C. of from 0.9140 to 0.9185, a thermal degree of from 34 to 47° C., a high viscosity of soap solution formed from the oil, an iodin number varying from 77.7 to 93.5, a saponification value of about 190, and a melting point of fatty acids from the oil from 21 to 26° C."

Report of the chemist, G. W. SHAW (*Oregon Sta. Rpt. 1898, pp. 38–55*).—An outline is given of the work of the department during the year and some of the results of investigations reported in earlier publications of the station are summarized. A table shows the character and acidity of 34 samples of soil from different localities in the State. Of the samples examined 60 per cent were acid. Analyses are given of 17 samples of prunes, 4 of strawberries, 2 of rhubarb, 13 of limestone, 3 of gypsum, 8

[1] Jour. Pharm. et Chim., 6. ser., 12 (1900), No. 3, p. 103.

of Paris green, and 14 of water. Notes are given on the results of an examination of headcheese considered as causing several cases of illness.

Report of the chemist, G. W. SHAW (*Oregon Sta. Rpt. 1899, pp. 20–27*).—Analyses are given of a number of samples of leachings from alkali soils. The alkali was generally of the black kind and was concentrated in the first 6 in. of the soil. Analyses are also given of 7 samples of gypsum, 4 of limestone, 3 of Paris green, 3 of soil, and 1 each of mixed hay, barley, salsify, laurel green, and crematory ashes.

Chemical division, H. J. WHEELER (*Rhode Island Sta. Rpt. 1900, pp. 279–292*).—A report of the work of the year in the chemical division in the following lines: Fertilizer and feeding stuffs inspection, methods of analysis, special chemical investigations, pot experiments, improvement of laboratory facilities, correspondence and publications, and miscellaneous analytical work. Under the last head are reported analyses of muck, air-slaked lime, ashes, calcium carbid waste, salt, sodium carbonate, muriate of potash, potassium carbonate, sulphate of potash, potassium nitrate, acid phosphate, dissolved boneblack, floats, tankage, fine-ground bone, nitrate of soda, sulphate of ammonia, dried blood, wool waste, rice meal, wheat bran, cotton-seed meal, corn meal, oats, cracked corn, linseed meal, boiled blood and bone, and three poultry feed mixtures (with narrow, medium, and wide nutritive ratios).

Detection of the adulteration of bone superphosphate, H. LASNE (*Rev. Phys. Chim., 4 (1900), p. 397; abs. in Chem. Ztg., 24 (1900), Nos. 28, Repert., p. 99; 78, Repert., p. 282*).—This is a description of the analytical methods employed by the author which have already been noted (E. S. R., 11, p. 104).

The theory and practice of the analysis of drinking waters, G. KABRHEL (*Theorie und Praxis der Trinkwasserbeurteilung. Munich: Oldenbourg, 1900, pp. VII+234*).

Permanent standards for use in the analysis of water, D. D. JACKSON (*Tech. Quart., 13 (1900), No. 4, pp. 314–326, figs. 4*).—This article describes the permanent standards already in use for the determination of color, turbidity, and nitrates, and discusses new standards proposed for the determination of ammonia, nitrite, and iron. For the determination of free and albuminoid ammonia and iron the author proposes the use of platinum-cobalt solutions; for nitrites, cobalt-copper solutions.

Preliminary experiments on the determination in cultivated soil of assimilable phosphoric acid, A. DE SIGMOND (*Ann. Sci. Agron., 1900, II, No. 3, pp. 451–463*).—In these experiments a comparison was made between the indications furnished by Schloessing's method of digesting in dilute nitric acid (E. S. R., 11, p. 131) and the results of pot experiments with phosphates on different soils. As a rule the soils showing a considerable percentage of phosphoric acid soluble in dilute nitric acid (in general 0.075 per cent) were not benefited by phosphatic fertilizers, although it was not always true that soils containing less than 0.075 per cent of phosphoric acid soluble in the nitric acid were in need of such fertilizers.

A simple and quick method for determining humus acid, H. BORNTRÄGER (*Ztschr. Analyt. Chem., 39 (1900), No. 12, pp. 790, 791*).—The method proposed is in general a modification of Messon's method for the examination of cochineal.[1]

On the analysis of peat, H. BORNTRÄGER (*Ztschr. Analyt. Chem., 39 (1900), No. 11, pp. 694–698*).—Brief directions are given for the determination of water, waxy substances, nitrogen, humus acids, and ash.

Determination of starch in potatoes, G. BAUMERT and H. BODE (*Ztschr. Angew. Chem., 1900, pp. 1074, 1111; abs. in Analyst, 26 (1901), No. 298, p. 20*).—In the method proposed the cellulose is first removed by digestion in an autoclave and filtering. The starch is then separated from nitrogenous and other substances by precipitation with alcohol in alkaline solution, dried and weighed. The loss of weight on ignition gives the amount of starch.

[1] Farben Ztg., 1900, p. 238.

Methods for the examination of milk, P. SOMMERFELD, translated by A. T. PETERS and R. S. HILTNER (*Chicago: A. Eger, 1901, pp. 96, figs. 7*).—This little volume is designed for the use of commercial analysts, inspectors, and health officers. It describes methods for the complete analysis of milk, detection of preservatives, detection of adulteration, estimation of insoluble foreign substances, examination of condensed milk, and the bacteriological examination of milk. The translators have followed closely the German edition, which undoubtedly accounts for the presence of some methods which are no longer employed in this country and the omission of others which are in common use. In other words, the book has been translated literally rather than adapted to American readers, although fortunately several footnotes, including one describing the Babcock test, have been added by the translators. An appendix contains a short bibliography.

The estimation of milk sugar in milk by polarization and by reduction, A. SCHEIBE (*Ztschr. Analyt. Chem., 40 (1901), No. 1, pp. 1–14*).—In a comparison of the two methods the author found average higher results by polarization. In order to correct this he proposes multiplying the results obtained by polarization by the following factors: For whole milk, fat content 2.8 to 4.7 per cent, 0.94; skim milk, 0.97. No factor is recommended for cream or colostrum.

The testing of milk for carbonate and bicarbonate of soda, P. SÜSS (*Pharm. Centralhalle, 1900, No. 41, pp. 465, 466; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 4 (1901), No. 2, p. 78*).—By adding 5 to 10 cc. of a 0.2 per cent alcoholic solution of alizarin to 100 cc. of milk a rose color will be produced in the presence of 0.05 to 0.1 per cent of carbonates of soda. In their absence only a light yellow color will result.

A new process for detecting sesame oil in vegetable and animal oils, TAMBON (*Jour. Pharm. et Chim., 6. ser., 13 (1901), No. 2, pp. 57, 58*).

Simple tests of the action of zymase, R. ALBERT (*Ber. Deut. Chem. Gesell., 33 (1901), No. 19, pp. 3775–3778*).

On the question of the inversion of cane sugar, E. O. VON LIPPMANN (*Ber. Deut. Chem. Gesell., 33 (1901), No. 19, pp. 3560–3564*).

Analyses of fruit essences, G. FABRIS (*Ann. Lab. Chim. Cent. Gabelle, 4 (1900), pp. 41–141; abs. in Jour. Chem. Soc. [London], 80 (1901), No. 458, II, p. 49*).

An improved method for the preservation of normal sodium hydrate, E. DOWZARD (*Chem. News, 83 (1901), No. 2146, pp. 18, 19, fig. 1*).—The solution is covered in the bottle with a layer of white mineral oil (B. P. 1898) ¼ in. thick. The bottle is connected with a filter pump by which any excess of solution which may have been siphoned off may be sucked back into the bottle.

The evolution of the thermometer, H. C. BOLTON (*Easton, Pennsylvania: The Chemical Publishing Co., 1900, pp. 98, figs. 6*).—This little book traces the history of the development of the thermometer from the time of Galileo's invention of his open-air thermometer to the present date. A list of authorities consulted is given.

An automatic temperature regulator, C. T. KNIPP (*Phys. Rev., 12 (1901), No. 1, pp. 47–49, figs. 3*).—This is an electric device for regulating the temperature of an electric heating apparatus.

A simple thermoregulator, A. VON KALECSINSZKY (*Ztchr. Analyt. Chem., 39 (1900), No. 11, pp. 698, 699*).

An apparatus for the generation of dry hydrochloric-acid gas, A. GWIGGNER (*Ztschr. Angew. Chem., 1900, No. 52, p. 1308, fig. 1*).

New laboratory apparatus, W. BERSCH (*Ztschr. Landw. Versuchw. Oesterr., 4 (1901), No. 1, pp. 4, figs. 3*).—An extraction apparatus with a special form of aluminum capsule and an apparatus for drying in different gases are described.

New laboratory apparatus, P. METZGER (*Ztschr. Analyt. Chem., 39 (1900), No. 12, pp. 791–794, figs. 3*).—A titration apparatus and devices for sampling solid and liquid substances are described.

BOTANY.

Report on the investigations at the climatological station of Juvisy during 1899, C. FLAMMARION (*Bul. Min. Agr.* [*France*], *19* (*1900*), *No. 5, pp. 860–864*).—In continuation of the investigations previously reported (E. S. R., 11, p. 907) the author reports upon the effect of different colored light on the development of plants, the persistence of the leaves of young oak trees when subjected to blue light, and the action of different parts of the solar spectrum on the coloration of plants. The experiments in radioculture, in which the effect of the different solar radiations in the development of the plants was investigated, gave results similar to those previously reported. The author found that there was no difference due to species or varieties, age of the plant, or whether shrubby or herbaceous. The maximum growth always took place in the red spectrum.

The experiments continued with the young oak trees in the blue light showed that their leaves were retained when subjected to this radiation. The action seems to be explained by the statement that the blue light prevents the transformation and transportation of the elaborated material which determines the fall of the leaves. It was found to have exercised some very marked influences upon the chlorophyll of the leaves.

The effect of the different radiations of the spectrum on the coloration of plants was further investigated with the result that the different portions of the solar spectrum influenced the coloration of the foliage and flowers of a number of species. The author states that the action of light on plant tissues is without doubt of a chemical nature, and in influencing coloration the light seems to liberate certain substances which react upon the chromoleucites.

Physiological experiments on the germination and growth of plants in rarefied air, F. SCHAIBLE (*Beitr. Wiss. Bot.*, *4* (*1900*), *pp. 93–148, pls. 8, figs. 3; abs. in Bot. Centbl.*, *82* (*1900*), *No. 2, pp. 52–54*).—The previous investigations on the effect of diminished atmospheric pressure on the germination and growth of plants are reviewed, and an account given of experiments with *Phaseolus vulgaris*, *Lepidium sativum*, *Satureia hortensis*, *Vicia faba*, and *Hortensia vulgare*, in which separate lots of seeds and plants were subjected to three different atmospheric pressures for a considerable period of time. A special form of apparatus was devised whereby the atmosphere could be changed without affecting the pressures, which were kept constantly at 570 to 580 mm., 170 to 180 mm., and 180 to 190 mm. As previously, it was found that under diminished atmospheric pressure the growth of plants was more vigorous than under normal barometric pressures, but that germination was slower and fewer seeds sprouted

than under normal conditions. The phenomena exhibited were the same as those shown by plants grown in atmospheres containing a diminished content of oxygen.

Notes on the germination and seedlings of certain native plants, S. COULTER (*Proc. Indiana Acad. Sci., 1898, pp. 215–222*).—In order to account for the distribution of certain species of plants, the author made a study of the effects of temperature and moisture changes upon the seedlings of a large number of common plants. Many of the plants experimented with produced large numbers of viable seeds, but the plants themselves do not seem to be becoming much more abundant. This applies particularly to the Compositæ, and the results of the experiments showed that among the Compositæ the percentage of germination is comparatively low. This is apparently due to an extreme sensitiveness on the part of the embryo to external conditions, to which should probably be added imperfect pollination. The seedlings of many plants are found to be extremely sensitive to temperature and moisture changes, either in the soil or atmosphere. These factors prove effectual in limiting the distribution of many plants.

Investigations on the formation of proteids by plants in darkness, MARIE MALINIAK (*Rev. Gén. Bot., 12 (1900), No. 141, pp. 337–343*).—The literature bearing upon this subject is briefly reviewed and the conflicting statements pointed out, after which the author gives the detailed results of her own experiments with maize and *Vicia faba*.

The experiments with maize were made by germinating the seed in sand in darkness, and after 8 or 10 days transferring to cultures containing saccharose and glucose. To some of the cultures asparagin and urea were added. The cultures were maintained for a number of days, the solutions being changed daily to prevent attacks of bacteria. At the expiration of the period, the plants were dried and the nitrogen determined by the Kjeldahl method, the albuminoids being determined by Stutzer's method. The experiments with maize demonstrated that in the presence of glucose and saccharose, together with asparagin, the plants were able to form albuminoid materials in darkness.

The experiments with *V. faba* were conducted in a similar manner with similar results.

The occurrence of calcium oxalate and lignin during the differentiation of the buds of Prunus americana, H. L. BOLLEY and L. R. WALDRON (*Proc. Amer. Assoc. Adv. Sci., 48 (1899), p. 304*).—The authors note the occurrence of crystals of calcium oxalate and the presence of lignified tissues, as observed in the study conducted upon the development of the buds of *Prunus americana*. It was found that the crystals of calcium oxalate occurred in very great abundance in the meristematic tissues of the bud, and in the very youngest stages

of the bud scales. As the tissues develop, the amount of calcium is lessened proportionately. While it is usually assumed that calcium oxalate is a waste product of metabolism, its occurrence in such large quantities would seem to indicate that it might have some definite value at this particular time in the life history of the plant.

On the poisonous properties of some alkaline compounds toward higher plants, H. COUPIN (*Compt. Rend. Acad. Sci. Paris, 130 (1900), No. 12, pp. 791–793*).—The author reports a series of experiments in which the poisonous effects of bromid, chlorid, iodid, nitrate, chlorate, acetate, and phosphate of calcium, strontium, and barium are shown by the action of their solutions upon the growth of wheat.

The compounds of calcium affected the plants unequally, the bromid, phosphate, and nitrate being but very slightly injurious, the iodid strongly, with the acetate and chlorid intermediate. The nitrate of strontium is but slightly poisonous, the bromid and chlorid somewhat more, while the iodid was extremely injurious. All of the compounds of barium were more or less injurious, the bromid being the least and the chlorate most poisonous, with the others intermediate, except the iodid, which was about as injurious as the chlorate. In general the poisonous properties of calcium, strontium, and barium increase with their atomic weights.

How crops grow; a treatise on the chemical composition, structure, and life of the plant, S. W. JOHNSON (*New York: Orange Judd Co., 1900, rev. ed., pp. VI + 416, figs. 69*).

Annual report of the consulting botanist, W. CARRUTHERS (*Jour. Roy. Agr. Soc. England, 3. ser., 11 (1900), pt. 4, pp. 731–741, figs. 14*).—Miscellaneous notes are given on a number of plant diseases, supposed poisonous plants, weeds, grass mixtures, and seed testing. The first appearance of the pear scab (*Fusicladium pyrinum*) in England is noted. Serious injury to beans by *Sclerotinia sclerotiorum* is reported. *Helminthosporium gramineum* reappeared on barley during the year, causing some loss. Notes are given on ergot, corn cockle, and *Lathyrus sativa* as poisonous to stock. A number of weeds are described and means for their destruction suggested. The report concludes with a description of a bacterial disease of turnips noted elsewhere.

Agrostological notes, F. LAMSON-SCRIBNER and E. D. MERRILL (*U. S. Dept. Agr., Division of Agrostology Circ. 27, pp. 10*).—Notes are given on studies made on the grasses of the herbarium of H. Muhlenberg. Two new species of Eatonia are described, as well as a new variety of *Panicum nashianum*. Notes are given on the nomenclature of various species and varieties of grasses, together with the publication by C. V. Piper of new names of *Melica bulbosa* and *Stipa occidentalis*. The names suggested for these grasses are *M. bella* and *S. thurberiana*.

Inventory of foreign seeds and plants, J. G. SMITH (*U. S. Dept. Agr., Division of Botany, Inventory No. 7, pp. 86*).—A catalogue of recently introduced seeds and plants is given which includes the collections of the explorers of the Section of Seed and Plant Introduction, as well as a large number of donations from miscellaneous sources. The principal sources through which the seeds and plants were obtained were W. T. Swingle, who collected in France, Algeria, and Asia Minor; M. A. Carlton, in Russia; S. A. Knapp, in Japan; and B. Lathrop and D. G. Fairchild, in South America and the West Indies.

The university botanic garden, J. B. Davy (*California Sta. Rpt. 1898, pp. 252–255*).—Brief notes are given on the donations to the botanic garden and lists are given of donors and materials received.

Notes on plants received for identification, J. B. Davy (*California Sta. Rpt. 1898, pp. 256–261*).—Notes are given on a number of plants received from different localities, in which suggestions as to their economic value are added.

The common origin of the tissue of leaves and stems in phanerogams, L. Flot (*Compt. Rend. Acad. Sci. Paris, 131 (1900), No. 27, pp. 1319–1322, figs. 3*).—A morphological study is given in which the various tissues are traced from the stem, through the buds into the leaves.

The influence of root curvature on the distribution and arrangement of roots, F. Noll (*Landw. Jahrb., 29 (1900), No. 3, pp. 361–426, pls. 3*).

Concerning Anthophæin, a brown coloring matter of flowers, M. Möbius (*Ber. Deut. Bot. Gesell., 18 (1900), No. 8, pp. 341–347*).—An account is given of the separation by the author from the dark brown portions of the flowers of *Vicia faba* of a coloring matter, to which the name Anthophæin is given. A similar substance is found present in many brown flowers.

The presence of dextrose and levulose in the leaves of the sugar beet, L. Lindet (*Sucr. Indig. et Coloniale, 55 (1900), No. 17, pp. 523–529*).

A new glucosid occurring in the seed of Erysimum, Schlagdenhauffen and Reeb (*Compt. Rend. Acad. Sci. Paris, 131 (1900), No. 19, pp. 753–755*).—The authors have separated from a number of species of Erysimum a new glucosid, to which the erysimin is given. Its chemical and physiological action are indicated.

Concerning the effect of hydrochloric acid upon the assimilation of plants, C. Wieler and A. Hartleb (*Ber. Deut. Bot. Gesell., 18 (1900), No. 8, pp. 348–358*).—As a result of investigations upon a number of plants, the author found that an atmosphere containing 1 part hydrochloric acid to 500,000 reduced the power of assimilation from 50 to 60 per cent.

Digestion in the leaves of nepenthes, G. Clautriau (*Extract Mem. Acad. Roy. Belg., 59 (1900), pp. 55*).

Concerning the cause, size, number, distribution, and function of tubercles on the roots of leguminous plants, L. Hiltner (*Arb. K. Gesundheitsamte, Biol. Abt., 1 (1900), No. 2, pp. 177–222, pl. 1*).—A critical review is given of the literature relating to this subject, in which the present status of the knowledge regarding root tubercles and their function is summarized.

The morphology and physiology of Mycoderma cucumerina, B. Heinze (*Landw. Jahrb., 29 (1900), No. 3, pp. 427–466, pls. 3*).—Studies are given on the morphology and physiology of this common mold, which occurs as a gray or grayish white mass upon solutions containing sugar or alcohol.

The growth and abnormal formation of conidia of Dematium pullulans, A. Klöcker and H. Schiönning (*Compt. Rend. Travaux Lab. Carlsberg, 5 (1900), No. 1, pp. 47–57, figs. 6*).—It was found that *Dematium pullulans* and other species of fungi, under similar conditions of growth, form their conidia in the interior of certain cells. The conditions causing this abnormal formation are lack of nutrition and too abundant humidity.

The capacity of fungi to absorb humin substances, F. Reinitzer (*Bot. Ztg., 1. Abt., 58 (1900), No. 4, pp. 59–73; abs. in Jour. Roy. Micros. Soc. [London], 1900, No. 6, p. 702*).—The author limits the term humus to those substances which are compounds of humin and confirms Hoppe-Seyler's statement as to their extreme power to withstand decomposition under ordinary circumstances. This, however, according to the author, applies only to the power of living organisms to extract carbon from the humus. If another source of carbon, as sugar, be present, Penicillium has the power of obtaining its nitrogenous constituents from humus, which must therefore be regarded as a source of nitrogen for soil organisms.

FERMENTATION—BACTERIOLOGY.

The bacterial air flora of the semidesert region of New Mexico, J. WEINZIRL (*Jour. Cincinnati Soc. Nat. Hist., 19 (1900), No. 7, pp. 211–242, figs. 4; Science, n. ser., 12 (1900), No. 303, pp. 578, 579*).—A study of the air flora of the semidesert region of New Mexico was made by exposing petri plates for 10 minutes. The number of plates exposed at one time was usually 3, the results given being averaged. Seventeen exposures were made near the University of New Mexico between September and May. An average number of bacteria falling upon the plates was 35.8. The lowest number, 3.8, was observed in February, and the highest, 71, in September. Quantitative determinations were made of the bacteria, and 11 determinations gave 143 bacteria per cubic meter. The bacteria found represented 14 species, 6 of which were chromogenetic. Four of these are micrococci, the remaining colonies being all bacilli.

The conclusions reached are as follows:

"(1) The air bacteria of our semidesert region presents a somewhat limited flora; but this is found to be widely distributed, due undoubtedly to the high winds which sweep uninterruptedly over our wide stretches of nearly barren mesas.

"(2) The actual number of bacteria contained in the air is not as large as in fertile and cultivated regions, but the number is not as small as is popularly supposed.

"(3) It would seem to follow from the above that sanitary measures and precautions should receive practically the same attention here as elsewhere. Disease-bearing materials, such as infected clothes, sputum, etc., should be carefully disinfected or burned.

"(4) Many of the species show highly-colored colonies; these belong mostly to the group of micrococci. The flora is characterized by its inertness toward sugar media and its failing to peptonize gelatin.

"(5) Apparently none of the species have been previously described."

The influence of the temperature of liquefied air on bacteria, A. MACFADYEN and S. ROWLAND (*Proc. Roy. Soc. [London], 66 (1900), Nos. 420, pp. 180–182; 430, pp. 339, 340*).—Experiments are reported in which 10 species of bacteria were exposed for 20 hours to the temperature of liquefied air ranging from −182 to −190° C. The cultures of the organisms were vigorous and were tested in both solid and fluid media. After they had been exposed to the temperature of the liquefied air, they were carefully thawed and examined. In no instance, whether on solid or liquid media, could any impairment of the vitality of the micro-organisms be detected. A second experiment was performed in which 50 liters of laboratory air, taken about 6 ft. from the floor, were liquefied, the temperature reaching about −210° C. Plate cultures were made from the contents of the bulb which had contained the liquefied air and were grown for a period of 10 days. The anäerobic plate cultures remained sterile while the aerobic plates yielded 44 organisms which had survived the exposure to −210° C.

In a second paper on this subject the authors, instead of exposing

a media in which the bacteria were growing to the temperature of the liquefied air, submitted the organisms to a cooling process in the form of broth emulsion in hermetically-sealed tubes. In this experiment the tubes were kept practically at -190° C. for 7 days; after which they were carefully thawed, opened, and the contents transferred to suitable culture media. The organisms employed were *Bacillus typhosus*, *B. coli communis*, *B. diphtheriæ*, *B. proteus vulgaris*, *B. acidi lactici*, *B. anthracis* (sporing culture), *B. phosphorescens*, *Spirillum choleræ asiaticæ*, *Staphylococcus pyogenes aureus*, a Sarcina, a Saccharomyces, and unsterilized milk. Cultures made at the conclusion of the experiment grew well, and in no instance could any impairment of the vitality of the organism be detected. In one or two instances growth was slightly delayed, an effect which might have been due to other causes. The photogenic bacteria grew and emitted light, and the samples of milk became curdled.

Effect of different degrees of light on the multiplication of water bacteria, F. T. Bioletti (*California Sta. Rpt. 1898, pp. 174–177*).—In order to throw light upon the question of whether the water of a storage reservoir could be best conserved from bacteral contamination by exposure to the direct sunlight, or by being roofed over to exclude the direct sun rays, or by being completely covered so as to leave the water in darkness, the author undertook a series of experiments in which samples of water were taken from the inlet of the reservoir, placed in glass dishes, 10 in. in diameter and 4 in. in depth, and kept under different conditions, viz, exposed to the direct sunlight, exposed to diffused light only, kept in a dark cupboard, covered with a thin layer of crude petroleum, and alum and lime or alum and salt added to precipitate the material in the water. In the latter cases the dishes were kept in diffused light. The bacterial content of different samples was determined at intervals, the number of bacteria in a cubic centimeter being shown in tabular form. The experiments showed that there was little difference in the bacterial content of the impure water, whether exposed to direct sunlight or kept in darkness, though what little difference there was was in favor of the sunlight. The effect of direct sunlight on certain bacteria is well known, but the author doubts whether this effect will extend to the lower parts of a deep reservoir. In practice the inconvenience attending exposure to direct sunlight more than overbalances the slight gain in the prevention of bacterial growth. Where the water was kept in the direct sunlight, there were many colonies of diatoms formed and various algæ grew at the bottom. The trouble from algæ in pipes and filters makes the prevention of their growth very desirable. Where the water was covered with a slight film of petroleum, none grew.

The effect of precipitation of bacteria by means of small quantities of alum and lime was quite marked. Impure water was rendered pure

and in one case very pure. The decrease of bacterial content reaches its maximum between 24 and 48 hours, after which there is a marked increase. This has an economic bearing, showing that where this method of purification is used on a large scale it is necessary to treat small quantities of water in separate reservoirs, to be used within the following day.

Fermentation of galactose, F. DIENERT (*Ann. Inst. Pasteur, 14 (1900), No. 3, pp. 139–189*).—Researches on the fermentation of galactose and the accustoming of yeasts to this sugar are summarized by the author. The process by which the yeasts become accustomed to and capable of fermenting galactose is called by the author acclimatization. Galactose is said to be a fermentable sugar when a yeast has become accustomed to it. The duration of acclimatization varies with the different species of yeasts, being quite favored with the lactose ferments. Glucose is fermented 1.6 times more quickly than galactose by acclimatized yeasts. The required characteristic of fermentation is lost if sugar other than glucose, lactose, or melibiose be offered to the yeast.

The morphological characters of yeasts are in no way altered by acclimatization. Certain substances, such as boric acid, toluene, etc., may prevent acclimatization without preventing fermentation of glucose. When a yeast has lost its zymase by cultivation in a medium rich in peptone, it can not be made to ferment galactose until it has been revived with glucose. But, if previously acclimatized to galactose, it can be revived with that substance. During the process of acclimatization only one zymase undergoes a change of constitution, and this change is attended with profound alteration of the protoplasm. The phenomena of acclimatization is a profound modification of the condition of the cell induced by a carbohydrate closely allied to glucose. A comparison is made between yeast ferments and antitoxins, which latter not only accustom leucocytes to toxins but also act as antidotes.

The essentials of practical bacteriology: An elementary laboratory book for students and practitioners, H. J. CURTIS and M. D. LOND (*London: Longmans, Green & Co., 1900*).

The elements of general bacteriology, N. GAMALEIA (*Elemente der allgemeinen Bacteriologie. Berlin, 1900, pp. 247*).

On the structure and development of bacteria, F. VEJDOVSKY (*Centbl. Bakt. u. Par., 2. Abt., 6 (1900), No. 18, pp. 577–589, pl. 1*).

A critical study of the processes of denitrification, O. LEMMERMANN (*Inaug. Diss., Jena, 1900, pp. 91*).

The physiology and morphology of alcoholic ferments, E. C. HANSEN (*Compt. Rend. Travaux Lab. Carlsberg, 5 (1900), No. 1, pp. 1–38, figs. 5*).—Studies are given on the varieties of Saccharomyces, in which the form of cells, formation of spores, budding, chemical action, growth in various nutrient media, and conditions of the various transformations undergone by the plant are described.

The formation of enzyms by alcoholic ferments, a specific characteristic, A. KLÖCKER (*Compt. Rend. Travaux Lab. Carlsberg, 5 (1900), No. 1, pp. 58–63*).—Studies are reported on a number of species of Saccharomyces, from which the author concludes that the formation of enzyms is quite constant among the different species.

Ferments and their action, C. OPPENHEIMER (*Die Fermente und ihre Wirkungen. Leipsic: Vogel, 1900, pp. VIII+350*).

Enzyms in plants, T. BOKORNY (*Naturw. Rundschau, 15 (1900), No. 27, pp. 337–340*).

The effect of liquid air on some ferments, POZERSKI (*Compt. Rend. Soc. Biol. Paris, 52 (1900), No. 26, pp. 714–716*).—A report is given of experiments in which the author subjected rennet, the diastase found in saliva, sucrose or invertin, amylase, inulase, trypsin and pepsin, to the action of liquid air for 45 minutes at a temperature of −191° C. Each of the experiments was repeated a number of times with new quantities of the ferments, the details of which are given. It appears from the investigation that subjecting the different ferments to the action of liquefied air at a temperature of −191° C. for 45 minutes was without effect upon their activity.

The influence of phosphates and other mineral substances on the proteolytic diastase of malt, A. FERNBACH and L. HUBERT (*Ztschr. Spiritusind., 23 (1900), No. 36, p. 330*).

A proteolytic enzym in germinating barley, W. WINDISCH and B. SCHELLHORN (*Wchnschr. Brau., 17 (1900), No. 24, pp. 334–336; abs. in Bot. Centbl., 84 (1900), No. 10, p. 321*).—An enzym similar to trypsin was found. Its characteristics are given.

The proteolytic action of Aspergillus niger, G. MALFITANO (*Ann. Inst. Pasteur, 14 (1900), pp. 420–448; abs. in Jour. Roy. Micros. Soc. [London], 1900, No. 6, p. 704*).—The author has determined the presence of a diastase in this fungus and has given it the name proteose. It resembles in its properties papayin and the proteolytic enzym of malt. It acts readily upon gelatin, nucleo-albumins, globulin, and albuminates, but has no effect whatever upon albumins. This last property distinguishes the proteose from pepsin, and its greater sensitiveness to alkaline phosphates distinguishes it from papayin.

A species of Mycoderma and its influence on beer, H. WILL (*Centbl. Bakt. u. Par., 2. Abt., 6 (1900), Nos. 17, pp. 560–565; 18, pp. 595–606*).—Studies are reported upon an undescribed species of Mycoderma found in wort and beer.

Concerning tobacco fermentation, O. LOEW (*Centbl. Bakt. u. Par., 2. Abt., 6 (1900), No. 18, pp. 590–593*).—A controversial article reviewing a number of published statements as to the causes of tobacco fermentation.

Remarks on the work of A. Macfadyen, G. H. Morris, and S. Rowland on expressed yeast cell plasma (Buchner's zymase), E. BUCHNER (*Ber. Deut. Chem. Gesell., 33 (1900), No. 17, pp. 3311–3315*).

Zymase from dead yeast, E. BUCHNER (*Ber. Deut. Chem. Gesell., 33 (1900), No. 17, pp. 3307–3310*).

METEOROLOGY—CLIMATOLOGY.

The fifth annual report for the year 1899 of the agricultural experiment station of Ploty (*Cinq. Rap. An. Sta. Expt. Agron. Ploty, 1899, pp. XXI+199, dgms. 5*).—This is a detailed account (in the Russian language, with a French résumé) of the work of this station in its meteorological department, agricultural and œnological chemical laboratory, and experimental fields and vineyards. Observations on precipitation, evaporation, humidity of the air, temperature of the air and soil, cloudiness, and solar radiation have received particular attention as being of especial interest to agriculture. Observations on atmospheric pressure and wind movement are also reported. The total precipitation for the year was 404.2 mm. (but was irregularly distrib-

uted, resulting in a severe drought in winter and spring and excessive rain in summer). The precipitation at the experimental farm of the station, which is situated in a deep valley 3.5 kilometers distant from the station, was 583.2 mm. The number of rainy days at the farm was 173, as against 114 at the station. The laboratory work reported consisted of analyses of the products of the experimental farm and vineyard, tests of analytical methods, especially those for nitrogen, phosphoric acid and potash, and examinations of rain water and lysimeter drainage water. The nitrogen of rain water was found to be mainly in ammoniacal form, rarely and in very small amounts as nitrites, and still more rarely in nitrates. The ammoniacal nitrogen varied during 9 months (July to March) from 0.4 to 7 mg. per liter. Frost and fog were richest in ammonia, containing from 9 to 13 mg. The rains of July and September were richest in ammonia. In July the soil received from rain water 1,022.2 gm. of nitrogen per hectare, in September, 1,142.96 gm. The rainfall was most abundant during these months. It was found as a rule that the more copious the rainfall the lower the proportion of nitrogen. Ordinarily the first portion of the rain was richer in nitrogen than that falling later. The total amount of nitrogen carried to the soil by atmospheric precipitation during the 9 months was 4,398.6 gm. per hectare (nearly 4 lbs. per acre).

In the drainage water from the lysimeter containing bare soil, not only ammonia, but considerable quantities of nitric nitrogen, were found; while in that from soil covered with vegetation only ammonia was found. Of 246.85 gm. of ammoniacal nitrogen carried to 1 hectare of soil by 22.8 mm. of rain, only 57.37 gm. was recovered in the drainage water. It is assumed that the remaining 189.46 gm. was nitrified. Of the 505.58 gm. of ammoniacal nitrogen supplied to 1 hectare of soil by the 46.7 mm. of atmospheric precipitation during 12 days of observation, it was found that 57.37 gm. were leached out in the drainage water, and it is estimated that 189.46 gm. were nitrified and 258.75 gm. disappeared. The latter was probably partly nitrified and passed into the drainage water, and partly escaped as free nitrogen. The total amount of nitric nitrogen found in the drainage water during the same period was 8,666.49 gm. per hectare. This is equivalent to 57.57 kg. of nitrates. It is estimated that the ammoniacal nitrogen furnished by atmospheric precipitation during the year yields on an average 4.586 kg. nitrate per hectare, while at the same time the soil elaborates independently 202.9 kg. The investigations show that vegetation exercises a very decided influence in reducing the losses of nitrogen in the drainage water.

The field experiments during 1899 consisted of tests of various rotations with and without fertilizers and manure, the adaptability of various crops, and the study of the influence of vegetation and methods of culture on the temperature and humidity of the air and soil.

Deep culture (to a depth of 27 cm.) of fallows in April and May resulted in an increase of soil moisture during the whole year. The deeper the culture the more pronounced was the effect in conserving moisture. The soils were driest under green fallow. Black fallow and April fallow resulted in increased growth of crops and gave better yields than May fallow. Winter wheat on soil which had been subjected to deep cultivation was not injured by the spring drought, while summer wheat was severely injured by lack of moisture. Mulching proved to be an effective means of conserving soil moisture. Applications of manure proved injurious, soils to which manure had been applied containing considerably less moisture than that which had been mulched. The culture of low-growing plants among those of larger growth gave very unsatisfactory results. Corn following carrots gave better yields than that following beets. This is ascribed to the fact that carrots exhausted the moisture of the soil less than beets.

Work at the station of agricultural climatology of Juvisy during the year 1899, C. FLAMMARION (*Bul. Min. Agr. [France], 19 (1900), No. 5, pp. 868–888, figs. 11*).—As in previous years (E. S. R., 11, p. 819), the author reports observations on temperature of the air and of the soil at different depths, atmospheric pressure, solar radiation, rainfall, underground water, and photography of clouds. The temperature for each day of 1899 and the means for 15 years (1885–1899) are reported in tables, and results for the whole year, for the seasons, and for the 15-year period are platted and discussed in some detail. Observations on the temperature of bare and sod soils at different depths were continued during the year with results which confirm previous observations, which showed that especially in the upper layer the sod soil was warmer in winter and colder in summer than the bare soil. The sunshine recorded for the year was 1,853 hours, furnishing 147,199 calories. The total rainfall was 448.4 mm. in 1899 as compared with 539.1 mm. in 1898. The number of days on which rain fell was 98. The year was very dry, especially during the months of February, March, and November. The observations on underground waters were the same as in previous years. These observations show that the temperature of the underground water at a depth of 14 meters is higher than that of the atmosphere at that point. The photographing of clouds of different types was continued during the year. Reproductions of two such photographs are given.

Meteorological observations, J. E. OSTRANDER and C. L. RICE (*Massachusetts Hatch Sta. Met. Buls. 142, 143, 144, pp. 4 each*).—Summaries of observations on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during October, November, and December, 1900. The general character of the weather of each month is briefly discussed, and the December bulletin gives a

summary for the year. The principal data in this summary are as follows:

Pressure[1] (inches).—Maximum, 30.75, February 28; minimum, 28.86, February 25; mean, 29.985. *Air temperature*[2] (degrees F.).—Maximum, 96, August 6; minimum, —8, February 3; mean, 48.3; mean sensible (wet bulb), 45; maximum daily range, 47.5, May 27; minimum daily range, 2.5, May 19; mean daily range, 21.8. *Humidity.*—Mean dewpoint, 39.2; mean relative humidity, 72.3. *Precipitation.*—Total rainfall or melted snow, 51.67 in., number of days on which 0.01 in. or more rain or melted snow fell, 131; total snow fall, 37 in. *Weather.*—Total cloudiness recorded by sun thermometer, 2,238 hours, or 50 per cent; number of clear days, 83; number of fair days, 144; number of cloudy days, 138. *Bright sunshine.*—Number of hours recorded, 2,216, or 50 per cent. *Wind.*—Prevailing direction, W.; total movement, 50,503 miles; maximum daily movement, 435 miles, February 26; minimum daily movement, 1 mile, November 29; mean daily movement, 138.4 miles; maximum pressure per square foot, 30.5 lbs., February 25, W. N. W. *Dates of frosts.*—Last, May 29; first, September 15. *Dates of snow.*—Last, April 9; first, November 9.

Meteorological summary for 1899, C. A. PATTON (*Ohio Sta. Bul. 120, pp. 249–261*).—This summary includes notes on the weather and tabulated daily and monthly records of observations at the station at Wooster, Ohio, on temperature, precipitation, cloudiness, direction of the wind, etc., and for comparison similar data for previous years and for other parts of the State. The following is a summary of results:

Summary of meteorological observations in Ohio.

	For the experiment station.		For the State.	
	1899.	Average for 12 years.	1899.	Average for 17 years.
Temperature (°F.):				
Mean	49.5	49.1	51.5	50.7
Highest	(Aug. 20) 95	(Aug. 8, 1891) 99	(Sept. 6) 105	(July 4, 1897) 113
Lowest	(Feb. 10) —21	(Feb. 10, 1899) —21	(Feb. 10) —39	(Feb. 10, 1899) —39
Mean daily range	22.9	20.5		
Greatest daily range	(Oct. 24) 52	(Oct. 6, 1895) 55		
Clear days	126	120		
Cloudy days	125	118		
Days rain fell	116	125	107	120
Rainfall (in.):				
Greatest monthly	(Sept.) 5.56	(July, 1896) 8.05		
Least monthly	(Aug.) 0.53	(Sept., 1897) 0.29		
Mean yearly	32.93	39.18	34.51	37.88
Prevailing direction of wind	S.	S.	SW.	SW.

Report of the meteorologist, N. HELME (*Rhode Island Sta. Rpt. 1900, pp. 347–364*).—This includes general notes on the weather during the year ended June 30, 1900, and a tabulated record of observations at Kingston on temperature, precipitation, cloudiness, and prevailing winds during each month from July, 1899, to June, 1900, inclusive, with a summary for the year ended June 30, 1900. The latter summary is as follows:

Temperature (degrees F.).—Maximum, 90, May 15, 1900; minimum, —5, February 27, 1900; mean, 48.3; highest monthly mean, 69.5, July, 1899; lowest monthly mean,

[1] Reduced to freezing and sea level.

[2] In ground shelter, 51 ft. below level of other instruments.

27.8, February, 1900; highest daily mean, 77, July 27, August 19 and 20, 1899; lowest daily mean, 7.5, February 27, 1900. *Precipitation* (inches).—Total (rain and melted snow), 51.67; greatest monthly, 7.26, September, 1899; least monthly, 1.21, June, 1900; greatest in 24 consecutive hours, 4, September 20, 1899; snow fall—total, 22; greatest monthly, 9, January, 1900; least monthly, 5, March, 1900. *Weather.*—Number of clear days, 141; number of fair days, 113; number of cloudy days, 111; number of days on which there was precipitation of 0.01 in. or more, 102. *Prevailing wind*, west.

Report of the international meteorological committee, St. Petersburg, 1899 (*Meteor. Council [Great Britain] Off. Doc. 148, 1900, pp. 110*).—This report gives an account of the proceedings and the papers presented at a meeting of this committee at St. Petersburg, Russia, under the auspices of the Imperial Academy of Sciences, September 2 to 7, 1899. The papers and reports presented were as follows: Report of the magnetic conference, by A. W. Rücker; Report of the proceedings of the cloud committee, by H. H. Hildebrandsson; Report of the proceedings of the international aeronautical committee, by H. Hergesell; Report on the experiments carried on in the atmosphere by unmanned balloons and kites at the observatory of dynamical meteorology at Trappes, by L. Teisserenc de Bort; Report on the exploration of the atmosphere by kites at the observatory of Blue Hill and other stations in America, by A. L. Rotch; The aeronautical scientific experiments at Berlin, by R. Assmann; Report on radiation, by J. Violle; Meteorology and seismology, by J. Milne; Report on the German expedition to the Antarctic regions, by von Drygalski; Report on the establishment of observatories at the centers of action of the atmosphere, by H. H. Hildebrandsson; The verification of alcohol thermometers, by Rykatcheff; The influence of the stray currents, from electric tramways, on the instruments for measuring terrestrial magnetism (illus.), by J. Edler; The publication of tables of the diurnal range of temperature, in the form of deviations of the hourly from the daily means, by J. Hann; Actinometry, by J. Hann; The installation of anemometers on level ground under identical conditions, by L. Teisserenc de Bort; The use of the wet and dry bulb thermometers at stations of the second order, by J. M. Pernter; On the cable to Iceland, by Paulsen; Explanatory notes on the proposal made by von Bezold and Neumayer with reference to the publication of ten-day reports of the weather; Proposed subcommittee to consider the improvement of the telegraphic weather service, by J. M. Pernter; and Results of the international simultaneous magnetic observations of February 28, 1896 (illus.), by A. Schmidt. A very complete bibliography of radiation is given in connection with the report on that subject by J. Violle, and of hygrometry in connection with the paper on wet and dry bulb thermometers by J. M. Pernter. A list of the publications issued under the authority of the Meteorological Council of Great Britain is also given.

West Indian hurricanes, E. B. GARRIOTT (*U. S. Dept. Agr., Weather Bureau Bul. H, pp. 69, charts 7*).—"This paper reviews the writings of the more prominent meteorologists of the nineteenth century, so far as they refer to the tropical storms of the North Atlantic, and presents a chronological list of West Indian storms for 400 years. It graphically illustrates and describes the more important hurricanes that have occurred during the last 25 years, and contains accounts, based upon local records and observations, of historical storms of the West Indies."

Prevention of hail storms by cannon, J. C. COVERT (*U. S. Consular Rpts., 65 (1901), No. 245, pp. 231-235, figs. 2*).—This is an account of observations made during a visit to the towns of Bois d'Oinget and Dénicé, in the south of France, where the method of cannonading to prevent hailstorms, described by Vermorel (E. S. R., 12, p. 316), is practiced. The belief of the wine growers in the efficacy of this method, as demonstrated by experience during 1900, is stated to be emphatic.

Climatological table for the British Empire for the year 1899 (*Symons' Mo. Meteor. Mag., 35 (1900), No. 419, pp. 163, 164*).—This is an annual summary of monthly climatological tables prepared from observations in all parts of the British Empire. The summary of the data reported is as follows: Highest temperature, in shade, 113.6° F., Adelaide, February 12; lowest, −46.5°, Winnipeg, February 8; greatest range, 135.9°, Winnipeg; least range, 21°, Grenada; highest mean temperature, 81.9°, Colombo, Ceylon; lowest mean temperature, 34.2°, Winnipeg; lowest mean humidity, 59°, Adelaide; highest mean humidity, 79°, Colombo, Ceylon; highest sun temperature, 175.7°, Adelaide; lowest, −16.5°, at Toronto; greatest rainfall, 73.52 in., Colombo, Ceylon; least rainfall, 17.87 in., Malta; greatest cloudiness, 5.7, Mauritius; least cloudiness, 2.3, Grenada.

Meteorological observations, A. O. Leuschner and Y. Kuno (*California Sta. Rpt. 1898, pp. 231, 232*).—This is a synopsis of observations at Berkeley on atmospheric pressure, temperature, precipitation, relative humidity, cloudiness, and direction of the wind during the 2 years ended June 30, 1899.

Meteorology of lower California, G. Eisen (*Bul. Amer. Geogr. Soc., 1900, No. 5, pp. 397–429*).—This is a part of an article on Explorations in the central part of Baja California, noted in *Science, 13 (1901), No. 319, p. 233.*

Meteorological record for 1899 (*New York State Sta. Rpt. 1899, pp. 467–478*).—Tables give a summary of monthly precipitation at Geneva, N. Y., during 18 years, 1882–1899, and daily and monthly records of the direction of the wind during 1899, and of the temperature during 1899, and during 10 years, 1890–1899.

The meteorological year, 1900, F. Marié-Davy (*Jour. Agr. Prat., 1901, I, No. 5, pp. 149–151*).—A quarterly and annual summary of observations at the Montsouris Observatory on atmospheric pressure, temperature, humidity, cloudiness, and winds is given, and the general features of the weather of the year are discussed.

Meteorological observations (*Rpt. Cawnpore Expt. Farm, 1899–1900, App., pp. 2a–4a*).—Tables give summaries of observations at the Cawnpore Farm, near Cawnpore City, on rainfall and temperature during the year ended May 31, 1900.

Meteorology of the Ordovician, F. W. Sardeson (*Amer. Geol., 26 (1900), No. 6, pp. 388–391, fig. 1*).

Rainfall at Emerald, Queensland (*Queensland Agr. Jour., 7 (1900), No. 6, pp. 499, 500*).—Monthly summaries for the period from 1887 to 1900, inclusive, are given.

Rainfall conditions of the Grand Duchy of Baden, C. Schultheiss (*Beiträge zur Hydrographie des Grossherzogthums Baden. Karlsruhe: Central Bureau of Meteorology and Hydrography of Baden, 1900, No. 10, pp. 40, figs. 3, charts 15, dgms. 8*).—This is a second revision, based on observations during 1888 to 1897. Detailed data are given in tables and illustrated in charts and diagrams. The organization of the service and the apparatus and methods used are explained.

AIR—WATER—SOILS.

Soils, lands, and soil moisture, E. W. Hilgard and R. H. Loughridge (*California Sta. Rpt. 1898, pp. 31–98, figs. 14*).—This includes reports on the examination of samples of soil from different parts of California, and studies of the endurance of drought in soils of the arid region and of moisture in California soils during the dry season of 1898. The investigations on endurance of drought in soils of the arid region have already been noted (E. S. R., 10, p. 617). Determinations of the moisture content of various kinds of soils to a depth of 4 ft. in

different localities in California during the dry season of 1898 are reported. The averages of these determinations for the different agricultural regions of the State are given in the following table:

Average percentages of moisture in California soils during the dry season of 1898.

	Total.	Free. *a*
	Per cent.	*Per cent.*
Foothills, 10 soils	9.7	2.6
Sacramento Valley, 23 soils	9.7	2.8
San Joaquin Valley, 19 soils	8.2	4.4
Coast Range, 44 soils	9.3	3.2
Southern California, 26 soils	6.8	2.6
State at large, 121 soils	8.7	3.1

a "Over and above what is held in the hygroscopic condition."

The following table shows the relative demands for total moisture by various crops on different kinds of soil:

Relative demands for moisture by crops on different soils.

	Hygroscopic moisture.	Total moisture.		Crops which did well.	Crops which suffered.
	Per cent.	*Per cent.*	*Tons per acre.*		
Sandy soils	1–3	2.0	160	Apricots, saltbush	Olives, peaches, plums, grapes.
		2.5	200	Olives, peaches, wheat	Cherries, pears.
		3.5	280		Citrus, prunes.
Sandy loam soils	3–5	4–5	400	Saltbush	Apricots.
		5–6	480	Apricots	
		6–7	560		Prunes.
		7–8	640	Almonds, plums	
		8–9	720	Apples, olives, peaches, walnuts.	
Loam soils	5	4–5	400	Saltbush	Apricots, almonds.
		5–6	480	Apricots, citrus, figs, walnuts.	
		6–7	560	Prunes, grapes	Prunes.
		7–8	640	Plums	
		8–9	720	Apples	Almonds.
		9–10	800	Almonds	
Clay loams	5–7	6–7	560		Peaches, plums.
		7–8	640		Wheat.
		8–9	720	Peaches, grapes	Sugar beets.
Clay soils	7–10	8–9	720	Apricots	Figs.
		9–10	800	Grapes	
		10–11	880		Wheat.
		11–12	960		Citrus.
		12–14	112	Corn, sugar beets	

NOTE.—The absence of a crop from a group simply indicates that it had not been found growing upon that particular soil.

"While the above table is interesting and useful in indicating the total amount of water required continually by crops on the various soils, and that as the soil increases in clayeyness the amount increases, because of the attraction for water on the part of the clay (hygroscopic), it is not a guide in determining the actual amounts required for particular cultures. This is found by eliminating the hygroscopic moisture and ascertaining the amount of free water present in soils where cultures grew and where they suffered, and comparing the results. This is shown in the following table, from which are omitted all determinations where no free water existed, as cultures very naturally suffered under such conditions, though maintaining life.

Amount of free water required by different crops.

Free water in 4 feet soil.		Cultures doing well.	Cultures suffering.
Percentage.	Tons per acre.		
0–1	80	Apricots, olives, peaches, soy bean	Citrus, pears, plums, acacia.
1–1.5	120	Citrus, figs	Almonds, apples.
1.5–2	160	Almonds, plums, saltbush	Barley.
2–2.5	200	Walnuts, grapes, eucalyptus	
2.5–3	240	Apples, prunes	Prunes.
3 –4	322	Pears, hairy vetch	Wheat.
4 –5	400	Wheat, corn	
5 –6	480	Sugar beets, sorghum	Sugar beets.

"The above summary indicates that the apricot, olive, and peach do well on less water than other orchard fruits, 1 per cent of free water being sufficient if constantly present. With this amount the citrus fruits, pears, and plums were found to suffer, though the citrus trees were in good condition with a little more water. The almond seems to require about twice the water that the apricot does, while the prune was found to suffer with three times the water in which the apricot was flourishing.

"Emphasis should be placed on the fact that this free water should be present throughout the soil to the depth of 4 ft. at least, and especially around the feeding rootlets of the tree. The surface of the soil may be wet, and yet the tree may suffer if the ground below be so dry that the rootlets are not able to draw sufficient moisture. This drying out of the under soil is one of the evil effects of a severely dry season, and unless the rainfall of the succeeding winter be sufficient to penetrate to the depth of several feet and moisten the soil around the rootlets the trees will suffer almost as if no rain had fallen.

"The same is true with regard to irrigation; those who have to resort to the artificial application of water to their lands because of insufficient rainfall, should so apply it that it may reach the tree rootlets at the depth of several feet below the surface."

Alkali and alkali soils, R. H. LOUGHRIDGE (*California Sta. Rpt. 1898, pp. 99–117, figs. 2*).—A study of the accumulation of alkali in irrigated soils used for the culture of citrus fruits, and the effect of this alkali upon the growth of these fruits, is reported, which showed that after 3 years' use of an artesian water comparatively free from soluble salts (9.46 grains per gallon containing 0.64 grains sodium chlorid and 1.85 grains sodium carbonate), the soil contained 3,240 lbs. of soluble salts per acre to a depth of 3 ft.; using Lake Elsinore water, containing 98.54 grains per gallon of soluble salts (in which there were 53.62 grains of sodium chlorid and 22.89 grains of sodium carbonate), there was an accumulation in the soil of 15,160 lbs. of alkali per acre, while in unirrigated natural soil there was only about 1,250 lbs. In case of the use of the lake water 1,680 lbs. of the alkali accumulated in the soil was sodium carbonate and 6,120 lbs. sodium chlorid; with artesian water there was 640 lbs. of carbonate and 360 lbs. of chlorid. The unirrigated soil contained neither of these salts.

It was observed that the citrus orchards irrigated with the Elsinore water were in bad condition and the station undertook to ascertain whether the injury to the trees was due to the effect of alkali or to

some other cause. Observations on the physical conditions of the lands, as well as the amount and distribution of the alkali, are reported and discussed. These indicate that while in many cases the injury to the trees was probably due to the direct action of the alkali, in some cases it was brought about by unfavorable physical conditions, due in part to the action of the alkali and in part to other causes. The effect of the different alkali salts on citrus trees and means of reclaiming injured orchards are explained.

Analyses of a large number of samples of alkali soils from different localities are reported.

Preliminary account of the soil survey work in North Carolina, B. W. KILGORE (*Bul. North Carolina State Bd. Agr., 21 (1900), No. 11, pp. 3-5*).—A brief account is given of the progress made by the State Department of Agriculture, cooperating with the Division of Soils of this Department, in examining and mapping the soils of a district 105 miles long and 8 miles wide, reaching from Raleigh to Newbern. In this survey the surface and subsoils have been examined with reference to their general character, the size and character of the particles, and the amounts of fertilizing constituents present, and the extent and exact location of each type of soil has been mapped. The work has shown that "omitting the section immediately around Raleigh and the more or less swampy or pocosin soils farther east . . . there are three large classes of soils in the east, each class having a number of varieties." The main classes are deep sandy soil, sandy loam with clay subsoil, and fine sandy loam with clay subsoil. It is proposed to make this survey of the soils the basis for experiments to determine the fertilizer requirements of the different soil types, and two test farms have already been established for this purpose. The plan of experiment followed and the results of the first year's operations are noted elsewhere (p. 941).

The Illinois glacial lobe, F. LEVERETT (*U. S. Geol. Survey Monograph, 38 (1899), pp. XXI+817, pls. 24, figs. 9*).—This monograph reviews earlier studies, describes the plan of investigation pursued by the author, and reports in detail the results of his studies of the Illinois glacial lobe, which "formed the southwestern part of the great ice field that extended from the high lands east and south of Hudson Bay southwestward over the basins of the Great Lakes and the north-central States as far as the Mississippi Valley. It overlapped a previously glaciated region on the southwest, whose drift was derived from an ice field that moved southward from the central portion of the Dominion of Canada as far as the vicinity of the Missouri River." The physical features of the region are described and the time relations or glacial succession of the various drift sheets are discussed. The evidence for separating the Illinoisan drift sheet from the outlying

and underlying drift and also from the Iowan drift is briefly set forth. Remarkable instances of the transportation without destruction of stratification of limestone ledges occupying in some instances areas of several acres are noted. Descriptions are given of well-defined soils and weathered zones which occur between successive accumulations of drift, as well as of moraines and associated sheets of till, and there is a general discussion on the influence of the drift on drainage systems. The thickness of the Illinoisan drift is estimated at from 100 to 130 ft. and its relation to the water supply is considered in detail. The essential conditions for obtaining artesian wells, as well as the occurrence of gas, are also considered. The sources of soil material are discussed and an attempt is made to classify the soils according to their origin and physical characteristics. Eight classes are recognized as follows: Residuary, bowlder-clay soils, gravelly soils, sandy soils, bluff-loess soils, silts slowly pervious to water, fine silts nearly impervious, peaty or organic soils. A statement of the origin or mode of deposition and the areal distribution of these soils is given in a table and their agricultural value and importance are discussed. The loess soils are of particular interest. Typical soils of this class are found bordering the rivers of the region, merging inland into less pervious white clays, one class of which is known as gumbo. This is an adhesive clay varying in color from ash or light gray to nearly black. The black portions are heavily charged with humus. This gumbo soil contains a few small pebbles which seldom exceed half an inch in diameter. It closely resembles the gumbo of the Illinois and Mississippi River flood plains, which is deposited by flooded streams in the portions of the flood plains where there is little current. The origin of this deposit and its time relations compared with the overlying loess and the underlying till have not yet been satisfactorily worked out.

The soil zones of European Russia in connection with the salt content of the subsoils and with the character of the forest vegetation, G. Vissotski (*Pochvovedenie* [*Pédologie*], *1* (*1899*), *pp. 19–26*).—It has been established that the soils of European Russia are distributed in zones in the following order, beginning at the north: (1) Podzol (siliceous) soils, (2) gray forest soils, (3) chernozem (black earth) soils, and (4) soils of the steppes—deserts. The quantity of the soluble salts in the subsoils increases in the same order. In the first zone the salts are entirely absent, in the second calcium carbonate is found, in the third calcium carbonate and gypsum, and in the last calcium carbonate, gypsum, sodium chlorid, potassium carbonate, etc. Conformably therewith each zone is characterized by a specific vegetation. The first is the region of mixed forests (fir, pine, birch, aspen, willow), the second of oak forests, the third of shrubby plants of the steppes (elder, hawthorn, spindle tree, cherry, privet, sloe, etc.), and the

fourth has the characteristic alkali lands vegetation (Astragulus, Ephedra, etc.) The importance of these facts in the practical work of reforestation is pointed out.—P. FIREMAN.

Lateritès, P. A. ZEMYACHENSKI (*Pochvovedenie* [*Pédologie*], *2* (*1899*), *pp. 117–122*). Notwithstanding the extended distribution of the laterites, information with regard to them is very limited. It is known only that they are very rich in ferric oxid (35 per cent and more). Recently M. Bauer communicated some entirely novel data concerning the nature of lateritic soils. From his analyses he concludes that in lateritic soils originating from granite and diorite, there occurs much free hydrate of alumina, so that they approach the bauxites in composition. The author does not agree with Bauer's conclusion. He analyzed two samples of lateritic soils, one from Mongon, China, and the other from the Caucasus (Chakva). The samples were treated with hydrochloric acid in three different ways: (1) By heating with 10 per cent hydrochloric acid 4 hours, (2) with acid of the same strength 10 hours, and (3) with strong hydrochloric acid (specific gravity 1.12) 10 hours on a water bath. From these experiments the conclusion was reached that in lateritic soils originating from feldspar there is present no free hydrate of alumina, and that the alumina is combined with silica and perhaps with ferric oxid.—P. FIREMAN.

On the spectrum of the more volatile gases of atmospheric air, which are not condensed at the temperature of liquid hydrogen, G. D. LIVEING and J. DEWAR (*Chem. News*, *83* (*1901*), *Nos. 2145*, *pp. 1, 2; 2146*, *pp. 13–15*).

Purification of air by soil, A. GÉRARDIN (*Compt. Rend. Acad. Sci. Paris*, *132* (*1901*), *No. 3*, *pp. 157–159*).

The molecular constitution of water, W. SUTHERLAND (*Phil. Mag. and Jour. Sci.*, *5. ser.*, *50* (*1900*), *p. 460; abs. in Chem. Ztg.*, *24* (*1900*), *No. 100*, *Repert.*, *p. 361*).—The author concludes from his investigations that steam is H_2O, ice $(H_2O)_3$, and water a mixture of $(H_2O)_3$ and $(H_2O)_2$. For the simple molecule H_2O the name "hydrol" is proposed.

Waters, E. W. HILGARD ET AL. (*California Sta. Rpt. 1898*, *pp. 118–130*).—This includes reports on analyses of 4 samples of creek and river water, the water of Lake Elsinore in 1890, 1891, 1897, and 1898, 16 samples of spring water, 38 of ordinary well water, 5 of artesian well water, and 8 of water from reservoirs and irrigation ditches with reference to mineral constituents, and of 7 samples of spring water and 5 of well water with reference to sanitary condition. The use of saline and alkali waters in irrigation is discussed and the conclusion is drawn that, "broadly speaking, any water unfit for domestic use on account of its saline contents should be used for irrigation only after an examination of the nature and amount of the latter. The limit usually given for drinking waters is 40 grains per gallon."

The disinfection of wells with potassium permanganate, E. DELORME (*Bul. Acad. Med.*, *1900*, *No. 25*, *pp. 643–648*).

Sterilization of water by ozonized air by the method of Abraham and Marmier, F. KRULL (*Ztschr. Angew. Chem.*, *1901*, *No. 3*, *pp. 57–59*, *figs. 2*).

The drainage and reclamation of marsh soils, GILLIAUX (*L'Ing. Agr. Gembloux*, *11* (*1900*), *No. 5*, *pp. 194–213*).

Soil temperature (*Rpt. Cawnpore Expt. Farm, 1899-1900, App., pp. 7a-10a*).—Summaries of observations at different depths during 1897–1900 are given in tables.

The cultivation of the soil, P. P. Dehérain (*Rev. Gén. Agron.* [*Louvain*], *9* (*1900*), *No. 9–10, pp. 405–412*).

The rôle of earthworms in the formation of cultivated soil, E. Henry (*Chron. Agr. Canton Vaud, 14* (*1901*), *No. 1, pp. 20-23*).

Acidity of upland soils, H. J. Wheeler and B. L. Hartwell (*Rhode Island Sta. Rpt. 1900, pp. 293–327, pls. 3*).—This article summarizes the results of pot and plat experiments on this subject which were begun in 1894 and have been reported from time to time (E. S. R., 9, p. 937).

"The general conclusion drawn from the various experiments herein outlined is that the recognition of a high degree of acidity, even in the case of upland and naturally well-drained soils, is one of the most important guides to the first step which should be taken toward their amelioration. This seems to hold true largely, if not wholly, regardless of whether the benefit accruing from the use of carbonate of lime is attributable to its correcting physical, biological, or chemical conditions. The practical importance of this matter, even though it has been heretofore almost ignored or unrecognized by most American and many European agricultural chemists, would seem to have been abundantly demonstrated in this and the two former papers upon the same subject."

Richmond River soils, F. B. Guthrie and C. R. Barker (*Agr. Gaz. New South Wales, 11* (*1900*), *No. 11, pp. 1005, 1006*).—Analyses of a number of samples of the virgin soils of this region show a remarkable uniformity. The average of the analyses is: Capacity for water 52 per cent, organic matter (humus) 16, lime 0.21, potash 0.08, phosphoric acid 0.3, and nitrogen 0.3 per cent. The reaction is neutral to acid. The general treatment of the soils is briefly discussed.

Note on the soil of County Camden, New South Wales, F. B. Guthrie and C. R. Barker (*Agr. Gaz. New South Wales, 11* (*1900*), *No. 12, p. 1123*).—The average results of examinations of about 80 samples of soils of this county, which are derived mainly from sandstone, are as follows: Capacity for water 49.73 per cent, organic matter (humus) 11.23, lime 0.113, potash 0.102, phosphoric acid 0.171, and nitrogen 0.231 per cent. The soils vary from light sandy loam to clay loam, their reaction from neutral to strongly acid. Forty-two per cent of the soils examined were strongly acid.

FERTILIZERS.

The manurial value of the excreta of milch cows, W. S. Sweetser (*Pennsylvania Sta. Bul. 54, pp. 7*). A record was kept of the amount and composition (nitrogen, phosphoric acid, and potash) of food eaten and of feces and urine excreted and milk produced by 2 cows, during the last 10 days of 5 periods of 40 days each. One cow was fed the same ration of 15 lbs. of mixed hay, 3 lbs. cotton-seed meal, 2 lbs. linseed meal, 2 lbs. corn meal, and 1 lb. buckwheat middlings, with a nutritive ratio of 1:3.9 throughout the experiment; with the other cow the same materials were used but the proportions were varied so that the nutritive ratios were 1:3.9 in the first and fifth periods, 1:6.1 in the second and fourth, and 1:8.7 in the third.

The total amount of nitrogen, phosphoric acid, and potash excreted by the 2 cows during the whole 5 periods in feces, urine, and milk.

with the percentage distribution of these constituents, are shown in the following table:

Fertilizing constituents in excreta and milk of 2 cows during 50 days.

	Nitrogen.		Phosphoric acid.		Potash.	
	Pounds.	Per cent of total excretion.	Pounds.	Per cent of total excretion.	Pounds.	Per cent of total excretion.
Feces	21.46	31.14	15.15	75.55	7.14	15.58
Urine	36.07	52.33	.29	1.42	34.19	74.56
Milk	11.39	16.53	4.71	23.03	4.53	9.86
Total	68.92	100.00	20.45	100.00	45.86	100.00

Summarizing these results, the bulletin states:

"(1) The feces from milch cows contain about one-third of the nitrogen, three-fourths of the phosphoric acid and one-sixth of the potash of the food.

"(2) The urine contains one-half of the nitrogen, almost no phosphoric acid, and three-fourths of the potash of the food.

"(3) The milk contains less than one-sixth of the nitrogen, one-fourth of the phosphoric acid, and one-tenth of the potash, or less than one-sixth of the manurial values of the food.

"(4) When the urine is allowed to run to waste, more than one half of the manurial value of the food, or 63 per cent of the manurial value of the solid and liquid manure, is lost."

Denitrification of nitrate of potash under the influence of reducing substances, M. KNOVALOV (*Izv. Moscow Selsk. Khoz. Inst., 6 (1900), pt. 1, pp. 62–65*).—This is a report of a study of the possibility of denitrification occurring without the intervention of micro-organisms, *i. e.*, under the influence of various reducing substances which occur in soil.

The first experiments were made with ferrous sulphate compounds which sometimes occur in the soil. Fifteen grams of nitrate of potash and 15 gm. of crystalline ferrous sulphate were dissolved in 300 cc. of water. Into this solution a current of air at 60 to 70° C. was led and afterwards passed through dilute sulphuric acid. Tests of the latter by means of Nessler's reagent showed that ammonia was slowly but invariably formed at ordinary temperatures.

All other experiments were made with humus. The latter was prepared from cane sugar by Berthelot's method.[1] The humus showed a scarcely perceptible acid reaction (to litmus) and contained 80 to 85 per cent of water, but no nitrogen.

The first tests were merely qualitative. Into each of two flasks were introduced 300 cc. of water, 15 gm. of nitrate of potash, and 15 gm. of humus. One flask was sterilized with water vapor at 100° C., the other by the addition of 0.4 gm. of corrosive sublimate. The stop-

[1] Ann. Chim. et Phys., 6. ser., 25 (1892), p. 366.

pered flasks stood at the temperature of the room 3 months. After the lapse of this period of time the presence of ammonia in each of the flasks was proved by Nessler's reagent. Nitrous acid was not found.

For a quantitative estimation of the ammonia formed four series of experiments were made:

(1) Ten flasks were charged as follows: To 200 cc. of water, 30 gm. of humus and 5 gm. of nitrate of potash were added. Each flask was sterilized with steam at 100° in three operations (1 hour on each of 3 successive days). The flasks were closed with a layer of cotton and a cork stopper and sealed with wax.

(2) Ten flasks were charged as before, but sterilized by the addition of 0.4 gm. of corrosive sublimate. The stoppered flasks were sealed with paraffin.

(3) Control experiments were made with two flasks containing 5 gm. of nitrate of potash and 200 cc. of water each, one sterilized, the other not, and with three flasks containing 30 gm. of humus in 200 cc. of water, one sterilized with steam, another with corrosive sublimate, the third not sterilized.

(4) Tests of the influence of caustic alkali, heating, air, and sand on the amount of ammonia formed.

Three Erlenmeyer flasks (large) received as much sand (washed and ignited) as was required to absorb 200 cc. of water with 30 gm. of humus and 5 gm. of nitrate of potash. The fourth flask received the same amount of sand, 200 cc. of water, and 300 gm. of humus. The first flask was sterilized with steam, the second with corrosive sublimate, and the third and fourth were not sterilized. All four flasks were closed with rubber stoppers carrying glass tubes through which air which had been drawn through sulphuric acid and cotton was passed from time to time (10 minutes each day).

In the fifth flask were placed 200 cc. of water, 30 gm. of humus, and 5 gm. of nitrate of potash, and 20 cc. of concentrated caustic soda. In the sixth flask the usual mixture was placed: 200 cc. of water, 30 gm. of humus, and 5 gm. of nitrate of potash. The flask was sterilized over an hour and was immediately examined for ammonia. The seventh flask was charged like the sixth, but was not sterilized. It was immediately examined for ammonia.

The determination of ammonia was made as follows: One-half of the liquid was placed in a distilling flask, a concentrated solution of caustic soda was added, and the mixture distilled. The distillate was collected in a standard solution of sulphuric acid and the excess of the latter titrated with caustic baryta. The indicator used was rosolic acid. In some cases ammonia was determined colorimetrically by means of Nessler's solution in order to avoid the heating of the mixture.

The flasks of series 1 and 2 were examined after standing 3 months.

Some of the sterilized solutions were tested for bacteria, but none were found. The amounts of ammonia found were as follows:

Amounts of ammonia found in different solutions (series 1 and 2).

	Series 1.	Series 2.
	Grams.	*Grams.*
No. 1	0.00220	0.001519
No. 2	.00038	.000656
No. 3a	.00045	.000288

a By Nessler's reagent without distillation.

Series 3 (control experiments) was examined after 2 to 4 months. No ammonia was found.

The results obtained in series 4 were as follows:

Ammonia found in series 4.

	Ammonia.		Ammonia.
	Grams.		*Grams.*
No. 1, examined after 48 days	0.001295	No. 5, examined after 15 days	0.0001899
No. 2, examined after 45 days	.000379	No. 6, examined immediately after sterilization	.0002
No. 3, examined after 45 days	.000294	No. 7, examined immediately, without sterilization	None.
No. 4, examined after 48 days	None.		

In all cases the ammonia was determined without previous decomposition of the humus which, as is well known and as the author proved by special experiments, retains ammonia. The above figures for ammonia are, therefore, too low.

Without making special claims for the accuracy of the quantitative determinations the author draws the following conclusions:

(1) Humus, as well as the ferrous salts, is able to reduce nitrate of potash to ammonia.

(2) This reduction proceeds very slowly at ordinary temperatures, but becomes more rapid on heating.

(3) Caustic alkali and free access of air do not destroy the ability of humus to reduce nitrate.

(4) Thus the possibility of denitrification of nitrate of potash in the soil under the influence of humus, without bacteria, is fully corroborated by laboratory experiments.—P. FIREMAN.

Fertilizer experiments with different sources of phosphoric acid, H. J. PATTERSON (*Maryland Sta. Bul. 68, pp. 29*).—An account is here given of experiments begun in the spring of 1895 on tenth-acre plats of moderately stiff clay naturally well drained, to test the comparative availability of double superphosphate (soluble and reverted), dissolved boneblack, dissolved South Carolina rock, iron and alumina phosphate (reverted), boneblack, raw bone meal, slag phosphate, ground South Carolina rock, and Florida soft phosphate. These different phosphates were each applied in amounts furnishing 150 lbs. of phosphoric acid per acre. The bulletin gives a discussion of

phosphatic fertilizers in general and a description of the particular phosphates used in these experiments, a record of treatment and cultivation of the plats since the beginning of the experiments, and a tabular summary and discussion of the data obtained in experiments with the different phosphates on corn, wheat, rye, and crimson clover. The results are summarized as follows:

"(1) All forms of phosphoric acid produced an increase of crop.

"(2) The average total yield of the crops fertilized with insoluble phosphoric acid was greater than those with the soluble and reverted forms of phosphoric acid.

"(3) Reverted phosphoric acid gave a greater total yield than soluble phosphoric acid.

"(4) Reverted phosphate of iron and alumina gave a higher yield than reverted phosphate of lime.

"(5) Soluble phosphoric acid gave slightly higher yields of wheat (grain) than phosphoric acid in any other form.

"(6) Concentrated sources of soluble phosphoric acid gave better results than the low grade sources.

"(7) Untreated South Carolina rock gave a higher total yield than dissolved South Carolina rock.

"(8) Slag phosphate produced a greater total yield and at less cost than the average of the soluble phosphoric acid plats and the bone meal plats.

"(9) Insoluble phosphoric acid from slag produced a greater yield than the insoluble phosphoric acid from South Carolina rock and Florida soft phosphate, but at greater cost than the two latter.

"(10) For the best results with insoluble phosphates, it is desirable to have the land well filled with organic matter. Of the methods tested, crimson clover was the best means of obtaining this."

Commercial fertilizers, E. H. JENKINS, S. W. JOHNSON, ET AL. (*Connecticut State Sta. Rpt. 1900, pt. 1, pp. 112*).—This includes a statement of fertilizer sales in Connecticut in 1900, the text and an abstract of the State laws relating to fertilizers, a list of manufacturers securing licenses under these laws, notes on the sampling and collecting of fertilizers, explanations regarding the analysis and valuation of fertilizers, a report on determinations of the solubility of organic forms of nitrogen in pepsin-hydrochloric acid, a review of the fertilizer market for the year ended October 31, 1900, and tabulated analyses and valuations of 466 samples of fertilizing materials, including nitrate of soda, sulphate of ammonia, dried blood, cotton-seed meal, castor pomace, ground fish, tankage, bone manures, dicalcium phosphate, superphosphate, muriate of potash, sulphate of potash, sulphate of potash and magnesia, kainit, carbonate of potash, nitrate of potash, cotton-hull ashes, wood ashes, limekiln ashes, crematory ashes, lime, land plaster, waste from acetylene manufacture, tobacco stems, muck, sheep manure, street sweepings, silk-mill waste. The average cost of nitrogen in 4 samples of nitrate of soda examined was 14.3 cts. per pound; in 1 sample of sulphate of ammonia, 18.5 cts.; in 44 samples of cotton-seed meal, 14.3 cts., "nearly a cent and a half per pound more than last year. This is due to an increased foreign demand for cotton-seed meal." The price per pound of nitrogen in 5 samples of castor

pomace varied from 15 to 20.1 cts. An unusually high percentage of chlorin was found in samples of sulphate of potash examined, some of these containing over 14 per cent of muriate of potash. It is recommended that this material should be purchased only on a guaranty of not over 2 per cent of chlorin. In 9 samples of muriate of potash examined the percentage of potash varied from 43.97 to 54.18, the cost per pound of the potash from 4.0 to 4.8 cts., averaging 4.3 cts. The average cost of the bone manures examined was $27.08 per ton, the average valuation $25.51. In 6 of the 25 brands examined the percentage of nitrogen was less than that guaranteed, in 4 the same was true of the percentage of phosphoric acid. The valuation of 4 of the 6 samples of dry fish examined was higher than the cost, "indicating that during the present year, as was also the case last year, dried fish had been a cheap source of nitrogen and phosphoric acid." Of the 90 samples of nitrogenous superphosphates examined 15 were below the manufacturers' minimum guaranty in respect to one ingredient, and 3 in respect to two ingredients. The average cost of the superphosphates was $30, the average valuation $19.75. Of 100 samples of special manures examined 14 did not fulfill the manufacturers' guaranty in respect to one ingredient and 2 were deficient in respect to two ingredients. The average cost of these manures was $32.73, the valuation $22.49. Analyses of 41 samples of cotton-hull ashes are reported.

"The highest percentage of water-soluble potash is 28.12 and the lowest 11.45. Excluding the latter—found in goods which were sold at a low price because of their inferior quality—the lowest percentage was 13.29 and the average of 40 samples was 19.89 per cent, nearly 3 per cent lower than last year.

"Allowing 4½, 4, and 2 cts. per pound for water-soluble, citrate-soluble, and insoluble phosphoric acid, the cost of water-soluble potash, in cotton-hull ashes, has ranged from 10.9 to 5.1 cts. per pound and has averaged 7.5 cts., eight-tenths of a cent more per pound than last year."

The water-soluble potash in 19 samples of wood ashes examined varied from 2.38 to 6.09 per cent, averaging 4.32 per cent.

Most of the nitrogenous fertilizers examined during the year were tested, as to availability of the nitrogen, by the pepsin-hydrochloric acid method. The results are summarized in the following table:

Solubility of nitrogen of fertilizers in pepsin-hydrochloric acid.

Fertilizer.	No. of samples tested.	Nitrogen dissolved. Maximum.	Minimum.	Average.
		Per cent.	*Per cent.*	*Per cent.*
Blood	1	....	....	84.0
Cotton-seed meal	2	91.0	89.0	90.0
Castor pomace	4	91.5	74.0	81.6
Bone	25	99.4	69.9	87.0
Tankage	5	82.8	73.1	76.3
Fish	5	87.6	61.5	73.5
Bone and potash	6	88.2	58.1	77.6
Superphosphates	90	91.7	18.9	74.8
Special fertilizers	99	100.0	57.8	76.4

"It is clear from these figures, as well as from other results previously published by this station and by other observers, that the solubility of organic nitrogen in materials generally regarded as quickly acting fertilizers, such as blood, cotton seed, castor pomace, fish, tankage, bone and the like, may range from about 60 to nearly 100 per cent.

"There is no reason to suppose that those with the lower solubility named are less effective fertilizers than those whose solubility in pepsin solution is relatively high.

"It is evident, therefore, that it would be quite possible to mix inferior nitrogenous matter, like leather, hair, etc., with its own weight of some approved form of nitrogen, which had exceptionally high solubility in pepsin solution, and produce a mixture which would not be certainly detected by the test described above. It is only when the solubility is 50 per cent, or lower, that it is reasonable to suspect the presence of inferior or inert forms of nitrogen."

On the fertilizing value of stable manure mixed with a litter of tobacco stems, N. Passerini (*Staz. Sper. Agr. Ital., 33 (1900), No. 5, pp. 441–445*).—Experiments are briefly reported in which tobacco stems were used as litter with stable manure, yielding a product after fermentation which had the following composition: Nitrogen 0.84 per cent, phosphoric acid 0.62 per cent, and potash 1.97 per cent, the tobacco stems supplying 0.26 per cent of nitrogen, 0.32 per cent of phosphoric acid, and 1.47 per cent of potash.

Filter-press cake as a fertilizer (*West Indian Bul., 1 (1900), No. 4, p. 395; abs. in Jour. Soc. Chem. Ind., 19 (1901), No. 12, p. 1125*).—It is stated that 1,000 lbs. of cake as obtained in the sugarhouse contains about 7 lbs. of nitrogen and 5 lbs. of phosphoric acid.

Jadoo fiber (*Jahresber. Vers. Stat. u. Schule, Wädensweil, 1897–98, pp. 49–50*).—This was found to be peat moss soaked in a solution of fertilizer material. Upon analysis it showed 0.76 per cent of nitrogen, 0.56 per cent of phosphoric acid, and 0.21 per cent of water-soluble potash.

Analyses of fertilizers, C. A. Goessmann (*Massachusetts Hatch Sta. Bul. 70, pp. 26*).—Analyses are reported of 231 samples of fertilizing materials, including wood ashes, sulphate of potash, muriate of potash, potash and magnesia sulphate, nitrate of soda, ground fish, cowpea and soy-bean plants, river and pond muck, sewage sludge, peat, soot, barnyard manure, sheep manure, cotton waste, product from garbage plant, tobacco stalks, bat guano, ground bone, dissolved boneblack, Florida rock phosphate, mixed fertilizers, and soils.

Fertilizer analyses, R. C. Kedzie (*Michigan Sta. Bul. 185, pp. 269–281*).—This includes tabulated analyses, accompanied by guarantees, of 81 samples of fertilizers examined during 1900, with brief explanatory notes.

Fertilizer analyses—fall season, 1900, B. W. Kilgore (*Bul. North Carolina State Bd. Agr., 22 (1901), No. 1, pp. 3–16, 19–29*).—This includes notes on valuation, freight rates from the seaboard to interior points, a list of fertilizers registered for 1901, and analyses and valuations of 131 samples of fertilizers. There are also included a brief report on analyses of miscellaneous fertilizing materials, including marls, wood ashes, cotton-hull ashes, compost, tobacco stems and dust, tobacco stem ashes, and barnyard manure, and a warning against a so-called manual of secret processes for the manufacture of home-made fertilizers.

Commercial fertilizers, H. J. Wheeler, B. L. Hartwell, et al. (*Rhode Island Sta. Bul. 73, pp. 39–50*).—This bulletin contains analyses and valuations of 59 samples of fertilizers examined during 1900 in addition to those reported in previous bulletins (E. S. R., 12, pp. 626, 737). In addition to the mixed fertilizers examined analyses are reported of 8 samples of wood ashes, 3 of muriate of potash, and 3 of nitrate of soda. A summary of the results of fertilizer inspection in the State during 1900 and previous years shows that in 1900 84.9 per cent of the fertilizers were equal to or above

the guaranty, 8.1 per cent were less than 0.3 per cent below the guaranty, and 7 per cent were more than 0.3 per cent below the guaranty, a condition not as satisfactory as that shown in 1895 and 1896, but slightly better than in 1899. The greatest discrepancies between the actual analyses and the guaranties were observed in the case of soluble phosphoric acid, for which the guaranties often exceeded the amounts actually found.

On the diffusion of nitrogen in chemical manure compounds, J. OSTERSETZER (*Chem. News, 83 (1901), No. 2145, p. 3*).—Attention is called to the fact that by the action of sulphuric acid the nitrogen of organic fertilizing materials is to a large extent converted in soluble form, including ammonium sulphate, and these nitrogen compounds are more thoroughly diffused throughout the mass of the fertilizer than is possible by mechanical means, a matter of great importance in estimating the relative value of fertilizers.

The distribution of chemical fertilizers, C. DUSSERRE (*Chron. Agr. Canton Vaud, 14 (1901), No. 1, pp. 17–20*).

Analyses of lime, W. H. WEIGAND and C. G. CHURCH (*Maryland Agr. Col. Quart., 1900, No. 10, pp. 4–6*).—Brief accounts are given of a study of the chemical composition of coal-gas lime, water-gas lime, shell lime, and unburnt oyster and clam shells.

Potassium nitrate in Wyoming, W. C. KNIGHT (*Science, n. ser., 13 (1901), No. 317, p. 151*).—The examination of samples of material found near Dayton, Wyo., which contained over 50 per cent of potassium nitrate, are reported.

The phosphates of the Florida hard rock region, C. ELSCHNER (*Chem. Ztg., 24 (1900), No. 101, pp. 1111–1113*).—A brief review of the history of these deposits, accompanied by descriptions and analyses of the phosphates.

The potash salt mines of Stassfurt (*Rev. Gén. Agron. [Louvain], 9 (1900), No. 9–10, pp. 412–426, pls. 2, figs. 5*).—This article discusses the location and importance of the Stassfurt deposits, the character of the crude and concentrated salts, and the production and consumption of the salts.

The world's production and consumption of mineral fertilizers, L. GRANDEAU (*Jour. Agr. Prat., 1901, I, No. 4, pp. 117–119*).—According to the figures given the total production of raw phosphate in 1899 was 2,500,000 tons, and of superphosphates in Europe, 3,505,000 tons. The greatest producers of superphosphate were France, 950,000 tons; Germany, 800,000 tons; Great Britain, 600,000 tons; Italy, 300,000 tons. The larger part of this superphosphate was consumed in the countries producing it.

FIELD CROPS.

A fertilizer experiment with barley, R. ULRICH (*Fühling's Landw. Ztg., 49 (1900), Nos. 14, pp. 533–538; 15, pp. 554–558*).—Thomas phosphate, kainit, nitrate of soda, and well-rotted barnyard manure were used alone and in combination for fertilizing barley on clay loam soil. The yields obtained with the different fertilizers and combinations, the profitableness of each, and their effect on the quality of the grain are shown in a number of tables. The largest and most profitable yields were obtained by the use of all 3 essential elements, as furnished by Thomas phosphate, kainit, and nitrate of soda. The water content of the air-dry grain was greater with fertilized than with unfertilized grain. The starch content increased with the addition of fertilizers and was most influenced by potash. The use of nitrogenous fertilizers increased the protein content of the grain while phosphoric acid and potash had a depressing effect.

Some varieties of winter barley, R. J. MANSHOLT (*Orgaan Ver. Oudleer. Rijks. Landbouwschool, 12 (1900), No. 140, p. 49*).—This article contains descriptions and records of trials of some varieties of barley, principally of the two-rowed and four-rowed kinds. Most of these trials were of hybrids, of which the most promising were double crosses. Two of these are particularly interesting from the fact that while they are of precisely the same parentage, one is a two-rowed and the other a four-rowed sort. They resulted from the following crosses: Groningen winter by Algerian two-rowed by Groningen winter barley. The fact that a summer barley enters into these crosses makes it doubtful whether they will endure a severe winter, but this point has not yet been tested.

The Canadian Mammoth and the English Matchless were tested but were discarded as not suited to the conditions prevailing on the experiment farm.—H. M. PIETERS.

Cooperative grass and forage plant investigations with State experiment stations, T. A. WILLIAMS (*U. S. Dept. Agr., Office of the Secretary, Circ. No. 8, pp. 14*).—Report of a visit to certain experiment stations in the West for the purpose of arranging for cooperative grass and forage plant investigations between the station and this Department through the Division of Agrostology. Cooperative experiments are suggested along the following lines: (1) The formation, care, and management of pastures, (2) range improvement, (3) alkali-resistant crops, particularly those best adapted to furnish forage that can be used to supplement the native ranges, (4) cover crops for soils liable to wash which will at the same time afford a supply of forage or can be turned under for green manure, (5) a continuous soiling series for use in sections where the dairy industry is paramount, (6) winter pasturage for the South and Southwest, (7) sand-binding grasses for the coast regions and along the Great Lakes, (8) meadow crops for higher altitudes, (9) supplementary forage crops, particularly those with a short season of growth that can be grown in rotation with wheat, cotton, and other primary crops, either for forage or for the improvement of soil fertility, (10) drought-resistant crops for arid sections, (11) the selection and development of improved varieties of grasses and forage crops adapted to special conditions and uses.

Experiment in top-dressing grass land, H. J. WHEELER and J. A. TILLINGHAST (*Rhode Island Sta. Bul. 71, pp. 15–20*).—A detailed account of the grasses grown, manures used, and the yield obtained per acre in 1899 on the grass lands here noted was given in an earlier bulletin (E. S. R., 11, p. 641). An early drought affected the yield of grass in 1900 and only one crop of hay was secured.

The plat fertilized with 1,200 lbs. of acid phosphate and 180 lbs. of muriate of potash but no nitrogen produced 1.6 tons of barn-cured hay per acre. When 150 lbs. of nitrate of soda was added to these

fertilizers on another plat the yield was at the rate of 2.24 tons per acre. And when 450 lbs. was so added on a third plat the yield was increased to 3.28 tons. The use of the 150 lbs. of nitrate of soda resulted in increasing the financial profits $6.94 per acre and the use of 450 lbs. in an increased value of $16.98 per acre. It is thought that this profit might have been greater had only 350 or 400 lbs. of nitrate of soda been used.

The relative proportion of timothy hay was decidedly increased by the nitrate of soda. "This was probably due largely to the removal of the nitric acid by the plants and the lessening of the soil acidity by the soda which was thus left behind."

Early applications of nitrate of soda to force growth, by placing at the disposal of the plants when moisture in the soil is abundant an immediate supply of available nitrogen, is believed to be especially valuable for grass in seasons of drought.

Reports on various seeds and plants included in the university distribution, E. J. WICKSON (*California Sta. Rpt. 1898, pp. 236–253*).—This includes brief reports by the station and statements of farmers regarding the growth and value of a number of plants and seeds distributed by the station.

Roselle (*Hibiscus sabdariffa*) promises to be of much value for jelly-making where currants do not thrive. It makes large returns in localities wherever there is a long frostless season combined with high summer heat. The local trials of fenugreek (*Trigonella fœnum græcum*) seem to indicate that the plant endures as low temperatures as it is likely to encounter in most valley situations, and is promising as a green manuring plant. Hairy vetch (*Vicia villosa*) promises to be one of the best winter-growing plants, both for forage and green manure purposes, in California. Besides hardiness against frost, it has a marked drought resistance. The mealy saltbush (*Atriplex halimoides*) gives promise of surpassing in value even the Australian saltbush (*A. semibaccata*) on dry lands, and gives indications of being of value in so-called desert situations.

Other plants reported upon are Jerusalem artichokes, Jersey kale, oat grass, Texas blue grass, brome grasses, buffalo grass, edible pod pea, Washington market sweet corn, carrots, climbing French bean, flat pea, etc.

Note on the growth of lupines on calcareous lands, E. W. HILGARD (*California Sta. Rpt. 1898, pp. 225, 226*). This note states that in the experience of the author lupines planted in the spring have given very unsatisfactory results on clayey and sandy soils. This season a test of sowing lupines in the fall gave very good results. The soil upon which this test was made contained 35 per cent of clay and fully 1 per cent of carbonate of lime and magnesia. The results of experiments with lupines made by Heinrich (E. S. R., 8, p. 969), which

led him to conclude that 0.5 per cent of carbonate of lime or magnesia is very deleterious to the growth of lupines, are discussed, but the author believes this to be true in the case of sandy soils only. The experiments here reported showed that on heavy clay soils double that quantity of carbonate of lime or magnesia was not injurious.

Potato experiments (*Agr. Gaz.* [*London*], *52* (*1900*), *No. 1390*, *p. 115*). The summarized results secured in 1899 by Wright at the West of Scotland Agricultural College in manuring potatoes are reported. The data given are the averages secured from 10 farms. On unmanured land the yield of potatoes was 5.02 tons per acre. When 20 tons of barnyard manure was applied, the yield increased to 7.85 tons. Where only half of this amount of barnyard manure was used, the yield was decreased 1.4 tons, and when to the full ration of 20 tons of barnyard manure was added 448 lbs. of superphosphate and 112 lbs. each of sulphate of ammonia and of potash, the yield was increased to 8.22 tons. The same amount of these commercial fertilizers used in connection with 10 tons of barnyard manure resulted in a yield of only 1,232 lbs. less than when the full application of 20 tons of barnyard manure was used. In a test of three potash manures for potatoes, the yields remained practically identical. The greatest amount of starch, however, was found in the potatoes fertilized with the sulphate. The best fertilizer, as regards economy and preparation for the succeeding crop, was that made up of 10 tons of barnyard manure, 448 lbs. of superphosphate, 112 lbs. of sulphate of ammonia, and 168 lbs. of sulphate of potash. Increased quantities of commercial fertilizers gave nearly as good yields at slightly less expense, but the value of barnyard manure for succeeding crops it is thought more than covered any slight advantage in the cheapness of the commercial fertilizers.

Experiments on potatoes in Yorkshire (*Agr. Gaz.* [*London*], *52* (*1900*), *No. 1384*, *p. 19*). A summarized account is given of a report issued by the Yorkshire College and certain county councils on experiments with potatoes in 1899. One of the chief experiments was the test of the substitution of commercial fertilizers for a part of the barnyard manure employed in a full dressing of 20 tons. The average results secured in experiments at 5 farms show a yield of 6.38 tons per acre where no manure was applied; with 20 tons of barnyard manure, the yield was 10.54 tons per acre. Where only half this amount of barnyard manure was applied, the yield averaged 8.95 tons per acre. Where to the 10 tons of barnyard manure there was added 156 lbs. of sulphate of ammonia, 336 lbs. superphosphate, and 224 lbs. of potash salts, the yield was raised to 9.92 tons per acre. When the sulphate of ammonia was omitted in the above formula, the yield was decreased 572 lbs. When superphosphate was omitted the decrease was 1,062 lbs. per acre. The use of commercial fertilizers alone at the rate of 336 lbs. of sulphate of ammonia, 560 lbs. of superphosphate, and 224

lbs. of sulphate of potash per acre did not give as good yields as was obtained from applications of 10 tons of barnyard manure. The average increased yield obtained with full dressings of barnyard manure, as compared with half dressings and the addition of the commercial fertilizers, was due largely to the greatly increased yields secured at one station. At another station the yield from the combination was larger than from the barnyard manure alone, while at 2 other stations it was nearly as large.

The influence of water and fertilizers on the composition of the ash of the potato, A. VON DASZEWSKI and B. TOLLENS (*Jour. Landw., 48 (1900), No. 3, pp. 223–249*).—Analyses of tubers and leaves (20 samples) of potatoes grown with little and with much water and with different kinds of fertilizers are reported and the methods used are described.

The Tucker ash apparatus (E. S. R., 11, p. 506) was used with excellent results. It was shown that the water content of the soil exerts a great influence upon the life of the potato plant and upon its assimilation of plant food. With the larger amount of moisture in the soil the potato plant took up a larger amount absolutely and a relatively smaller amount of potash and phosphoric acid than with the smaller amount of moisture, the assimilation of the potash and phosphoric acid going hand in hand. Relatively more calcium and chlorin were taken up in case of the larger moisture supply. The fertilizers influenced both yield and composition. Nitrogenous fertilizers increased the nitrogen content of both the leaves and tubers. The reduction of starch content which occurred when the larger amount of water was used was more largely influenced by calcium chlorid than by any other substance applied.

Culture of resistant, nonseed producing sugar beets, J. WENDENBUSCH (*Deut. Landw. Presse, 27 (1900), No. 11, pp. 107–109*).—Cold, wet, or otherwise unfavorable weather conditions during the early stages of growth of sugar beets tend to further the premature development of seed-bearing specimens and thus reduce the net yield of normal beets per acre. The author has attempted to meet these difficulties by growing beet seed on a cold clay upland soil where beets grown from commercial seeds even in favorable years produced a high percentage of premature seed beets. By careful selection of seed for a number of years on this cold upland soil a strain of seed has been obtained which is very resistant to cold and which, when planted under more favorable soil and climatic conditions, produced crops containing much lower percentages of premature seed beets than are obtained from seeds grown under normal conditions.

In 1899, an unfavorable season for sugar-beet culture, sugar-beet seed from 3 different seedsmen was planted in a favorable locality alongside of beet seed grown on the cold, heavy upland soils noted

above. The commercial seeds produced crops containing from 9 to 11.5 per cent of premature seed specimens, while the seed grown on the cold, upland clay produced a crop containing but 2.7 per cent of premature seed specimens. The results of the investigation are thought by the author to have an important bearing on the beet-sugar seed industry.

Tobacco culture experiments in Russia, P. LOMONOSOV (*Rpt. Tobacco Expt. Sta. Lokhvits Agr. Soc. 1893, 1894, and 1895, pp. IV+116*).—This report on tobacco work near Lokhvits, Government of Poltava, in southern Russia, is introduced with a general discussion of tobacco culture in that region. The work here described consisted of plat experiments with the commonly grown variety known as Makhorka and considered as yielding a leaf of good quality. The soil on which the experiments were carried out was the typical valley chernozem common to that section of Russia. The upper 18 in. of the soil is somewhat sandy and dark gray in color, the next 28 in. is light gray, somewhat yellowish, and contains carbonates, and the subsoil is a light gray loess. The results showed that decreasing the distance between plants increased the yield but decreased the weight of the leaf and of the entire plant and was detrimental to the quality. The best distances were 21 by 14 and 21 by 10½ in. When planting 21 by 14 in. apart it is recommended to leave 7 or 8 leaves per plant. This increases the yield 40 per cent as compared with the usual practice of leaving from 4 to 6 leaves. The same results may be obtained by planting 21 by 10½ in. apart and leaving 6 leaves per plant. Watering the young plants proved beneficial. Starting tobacco directly in the field without the preliminary growth of the plants in hotbeds is considered profitable only when atmospheric conditions are favorable. A large number of leaves per plant, close planting, and frequent watering and cultivating delayed maturity. The average loss of weight in curing the leaves was 75.62 per cent.

The basis for the improvement of American wheats, M. A. CARLETON (*U. S. Dept. Agr., Division of Vegetable Physiology and Pathology Bul. 24, pp. 87, pls. 10, figs. 5, map, 1*).—This bulletin describes the characteristics and needs of the several wheat districts in the United States, and suggests how the desired qualities to satisfy these needs may be obtained. The characteristics of the different botanic groups of wheat are considered according to the following classification: *Triticum vulgare*, *T. compactum*, *T. durum*, *T. turgidum*, *T. polonicum*, *T. spelta*, *T. dicoccum*, and *T. monococcum*. In general it is stated *T. vulgare*, *T. polonicum*, and *T. monococcum* are considered as species, while the rest are ranked as subspecies. The desirable and undesirable qualities of the several groups are enumerated.

The author divides the United States into eight different wheat growing districts. In the soft wheat district, including mainly the

Middle and New England States, the chief varieties grown are Fultz, Fulcaster, Early Genesee Giant, Mediterranean, Early Red Clawson, Longberry, Jones Winter Fife, Red Wonder, Gold Coin, and Blue Stem, and the present average yield is about $14\frac{2}{3}$ bu. per acre. The semihard winter wheat district, comprising Ohio, Indiana, Illinois, Michigan, and a small part of Wisconsin, grows chiefly Fultz, Poole, Rudy, Valley, Nigger, Dawson Golden Chaff, and Early Red Clawson. The average yield per acre for the district is about 14 bu. The southern wheat district, including approximately the Southern States, has an average yield per acre of about $9\frac{2}{3}$ bu., the varieties commonly grown being Fultz, Fulcaster, Red May, Rice, Everett High Grade, Boughton, Currell Prolific, and Purple Straw. The northern portion of the States of the plains constitutes the hard spring wheat district, with an average yield per acre of about 13 bu., and with Saskatchewan Fife, Scotch Fife, Powers Fife, Wellman Fife, Hayne Blue Stem, and Bolton Blue Stem as the chief varieties grown.

The hard winter wheat district covers the central portion of the States of the plains. The average yield per acre in this district is about $12\frac{2}{3}$ bu., and the chief varieties grown are Turkey, Fulcaster, May, Zimmerman, and Fultz. In the durum wheat district, which covers the southern portion of the States of the plains, the chief varieties grown are Mediterranean, Nicaragua, Fulcaster, and Turkey, the average yield being $11\frac{1}{2}$ bu. per acre. The irrigated wheat district, comprising approximately the Rocky Mountain and Basin States, shows the highest average yield per acre, about 21 bu., with Sonora, Taos, Felspar, Little Club, Defiance, and Amethyst as the chiefly grown varieties. The white wheat district has an average yield per acre of about $14\frac{4}{5}$ bu., and Australian, California Club, Sonora, Oregon Red Chaff, Foise, Palouse Blue Stem, Palouse Red Chaff, White Winter, and Little Club are the chief varieties.

In all districts, except in the semihard winter wheat district, early maturity is a quality to be sought. Hard winter varieties are needed everywhere except in the southern, durum, and irrigated wheat districts. Rust resistant varieties are needed in the soft, semihard winter, southern, hard spring, and durum wheat districts. Harder grained and glutinous varieties are required in the soft wheat district, semihard winter, and irrigated wheat districts. Drought resistance is a quality especially required for varieties in the hard spring, hard winter, and durum wheat districts. The author further mentions macaroni varieties needed in the durum wheat district, nonshattering varieties in the white wheat district, and varieties resisting late spring frosts and with an increased stiffness in the straw in the southern wheat district.

An outline of the geographic distribution of wheats of different qualities is also given. The work of improvement, which is continu-

ously carried on, and the results that have already been attained in various ways by the Department of Agriculture, and other agencies, are discussed. A comparative résumé of the principal qualities of 245 representative wheats of the world, grown experimentally by the Department of Agriculture, are presented in a table.

First report of work on the department's test farms for the season 1900, B. W. KILGORE ET AL (*Bul. North Carolina State Bd. Agr., 21 (1900), No. 11, pp. 6-53, pls. 6*).—The work described comprises fertilizer and other tests with corn, cotton, potatoes, sweet potatoes, grasses, and leguminous plants carried on at Tarboro and Red Springs farms. An outline of the methods and purposes of the tests is given.

The experiments with corn showed nitrogen to be most needed in the soil, but, in general, its cost made the increased yield expensive. Applying one-half the nitrogen in the form of cotton-seed meal at planting time and the rest during the growing season gave good results, but substituting nitrate of soda for cotton-seed meal as an after dressing proved more effective. Comments are given on all the results, but general conclusions are reserved on account of insufficient data. A paper on Leguminous plants for forage and soil improvement, by J. F. Duggar, read at a meeting of Commissioners of Agriculture of the cotton States is reproduced.

Collection and distribution of grass seed—field work (*U. S. Dept. Agr., Office of Secretary Circ. 9, pp. 11*).—This circular is a brief report to the Secretary of Agriculture on the work of the Division of Agrostology in the direction of purchasing and collecting seeds and specimens of valuable economic grasses and forage plants for the purpose of distributing them to the various experiment stations, and of the field work for the season of 1900. The work was in charge of C. L. Shear of that Division. A list of particularly promising grasses of which seeds were secured in quantity is given and the merits of each species briefly noted. This list comprises dry meadow and range grasses, wet meadow grasses, soil and sand binding species, and alkali soil and subalpine species.

Frost injury to crops and methods of its prevention, A. TRAMPE (*Landw. Ztschr. Rheinprovinz, 1 (1900), No. 22, pp. 255, 256*)—An article describing in a popular manner the culture of fall grains and calling attention to the importance of the variety of grain, kind of seed, and manner of sowing, and the fertilization and preparation of the soil, in resisting cold winters.

Investigations on the stooling of grains, W. RIMPAU (*Landw. Jahrb., 29 (1900), No. 4-5, pp. 589-628, figs. 3*).—This article is a translation of a report on experiments by E. Schribaux, and a series of controversial letters on the subject which appeared in the *Journal d'Agriculture Pratique.*

Of what value is the stooling of grains? EDLER (*Fühling's Landw. Ztg., 49 (1900), Nos. 22, pp. 850-852; 23, pp. 871-876*).—A discussion of Schribaux's work, published originally in the *Journal d'Agriculture Pratique.*

Methods of growing barley of a low nitrogen content for brewing purposes on light soils, T. REMY (*Centbl. Agr. Chem., 29 (1900), No. 12, pp. 809-811*).

Chicory growing, M. G. KAINS (*U. S. Dept. Agr., Division of Botany Circ. 29, pp. 12, figs. 3*).—A popular publication on the culture of chicory for its various uses. A bulletin on this subject by the same author is abstracted in E. S. R., 10, p. 236.

Cotton monograph; culture, economic history, H. LECOMTE (*Le coton monographie; culture, histoire, économique. Paris: Georges Carré & C. Naud, 1900, pp. 494, figs. 37*).—Part 1 treats comprehensively of the history, botany, and physical and chemical character of cotton, cotton by-products, culture of cotton in the United States and other American countries, diseases and insects affecting cotton culture in Egypt and other countries of Africa, in Europe, and Asia. Part 2 discusses the cot-

ton industry and treats of the uses of cotton, and of the progress of the cotton industry in different countries of the world. A bibliographical index is given, which contains a list of 137 papers, books, etc., on cotton.

Hops in their botanical, agricultural, and technical aspect, and as an article of commerce, E. GROSS (*London: Scott, Greenwood & Co., 1900, pp. 341, figs. 78; transl. from German by C. Salter*).—The history of the hop; the hop plant, its cultivation, preservation, and storage; physical and chemical structure of the hop cone; statistics of production, methods of judging the value of hops, and the hop trade, are considered in a comprehensive manner from the European standpoint.

History of the potato treated from the historical, biological, pathological, cultural, and utilitarian standpoint, E. ROZE (*Histoire de la pomme de terre traitée aux points de vue historique, biologique, pathologique, cultural, et utilitaire. Paris: J. Rothschild, 1898, pp. XII + 464, pl. 1, figs. 158*).—An exhaustive monograph on the potato. Part I discusses the wild potato, giving extended attention to the native home of potatoes and the history of its introduction into England, France, and Continental Europe. Part II takes up the biology, insects and diseases, culture, and use of the potato. The chapter on diseases contains the results of the author's personal observations. The chapter on potato uses discusses potato starch, manufacture of sirup, dextrin, and spirits from potatoes, in addition to the usual uses as food and forage.

Experiments in grafting potatoes, E. LAURENT (*Bul. Roy. Soc. Bot. Belg., 39 (1899), pp. 9, 85; abs. in L'Ing. Agr. Gembloux, 11 (1900), No. 5, p. 213*).—Experiments were made to study the reciprocal influence of grafting light-fleshed and colored varieties of potatoes on each other. The Négresse potato, a variety characterized by deep violet-colored tubers, was grafted on Simson, Boule d'Or, and Blue Giant potatoes, varieties with light-colored tubers. In one series cleftgrafting of the vines was practiced and in another a cylindrical piece 15 mm. in diameter was taken from one tuber and replaced by a piece of similar size from the other. The tests extended over a period of 3 years. The results show that the violet coloring matter elaborated in the leaves of the Négresse variety was in no instance stored up in tubers of the light-fleshed varieties.

Experiments on the manuring of potatoes in 1899, R. P. WRIGHT (*Bul. West of Scotland Agr. Col. 1900, No. 4, pp. 3-26*).—The data here reported have been in part summarized from another source (see above).

The "other side" of ramie (*Planting Opinion, 5 (1900), No. 48, p. 816*).—A popular note on the practicability of manufacturing fabrics from ramie fiber, showing that existing conditions are not promising.

Sorghum, G. W. SHAW (*Oregon Sta. Rpt. 1900, pp. 21-23*).—Cooperative experiments with a number of varieties of sorghum for sirup making were carried on and the results of analyses of the canes are presented in a table.

Spelt (Triticum spelta), C. A. ZAVITZ (*Farming World, 18 (1901), No. 19, pp. 448, 449*).—Fifteen bushels per acre of grain in the chaff was the best yield obtained by the author in a test of 5 varieties of spelt. The average yield of straw per acre was ¾ ton.

Sugar beets in 1897, M. E. JAFFA (*California Sta. Rpt. 1898, pp. 136-142*).—Tabulated results of analyses of sugar beets grown in several counties of the State and at the experiment station and the substations during the season of 1897 are reported. The beets at the stations grown on alkali soils, averaging about 5,000 lbs. of soluble salts to the acre, varied in sugar content from 10.92 per cent in Dunesnay to 18.12 per cent in Vilmorin Ameliorée, with a purity coefficient of 71.50 and 90.14, respectively. The average sugar content of all samples was 14.10 per cent. The weight of sample beets varied from 7.5 to 28.3 oz.

Some interesting experiments on sugar-beet culture, L. GRANDEAU (*Jour. Agr. Prat., 1900, II, No. 51, pp. 896, 897*).—A partial book review of a recent work

entitled Successful sugar-beet culture (Ertragreicher Zucker-Rübenbau), by F. Kiehl. The book is a résumé of a long series of practical and methodical observations made by the author, who has grown sugar beets for 40 years and who for the last 14 years has given his attention to their culture on a large scale. The subjects considered in the work are rotation, fertilization, methods of cultivation, number of cultivations by hand, distance between plants, time of thinning and harvesting, and varieties. This article treats of the rotations and the application of barnyard and sheep manure.

Beet-sugar industry in Germany in 1899–1900, L. Grandeau (*Jour. Agr. Prat., 1900, II, No. 52, pp. 933, 934*).—This article, based on the exhibits at the Paris Exposition and the publications issued for that occasion, treats of the condition of the beet-sugar industry in Germany at the present day.

Beet roots and their crowns, G. W. Shaw (*Beet Sugar Gaz., 2 (1900), No. 11, p. 5*).—This article briefly discusses the comparative richness of beet roots and their crowns and gives the results of a study on the subject. The average results of 228 analyses show a difference of 2.09 per cent of sugar in the juice and 6.69 per cent in the purity coefficient in favor of the beet roots as compared with the crowns.

Influence of sugar-beet culture on the yield of grain, J. Bénard (*Semaine Agr., 20 (1900), No. 1020, pp. 385, 386*).—In this article the author gathers data from different countries and shows that sugar-beet culture considerably increases the yield of the grain crops which follow.

The culture of tobacco, Makhorka (*Report of the experiment plantation of the Lokhvitz Society of Agriculturists for 1896 and 1897; rev. in Selsk. Khoz. i Lyesov., 196 (1900), Feb., pp. 379–439*).—An extended series of experiments is described relating to the denseness of planting, the influence of hoeing, irrigation, of different methods of cultivation, of deep plowing, of manure and mineral fertilizers, etc. The experiments are being continued and no final conclusions have been reached as yet.—P. FIREMAN.

Nicotin in California-grown tobaccos, G. E. Colby (*California Sta. Rpt. 1898, pp. 149–154*).—The author reviews the work of other stations in this line and reports the percentage of nicotin found in the water-free substance of 11 varieties of tobacco grown on the station plats. The nicotin content varied from 2.23 per cent in Vuelta Abajo to 9.03 per cent in Pano de Sumatra. Conqueror Louisiana and Brazilian were the only other varieties with a nicotin content under 5 per cent. From this preliminary work the author concludes that the cigar-leaf varieties give promise of success under California conditions.

Velvet bean and cowpeas (*Jour. Jamaica Agr. Soc., 4 (1900), No. 12, p. 724*).—A brief note comparing the growth of the two plants in Jamaica.

Wheat trials (*New Zealand Dept. Agr. Rpt. 1900, pp. 316–326, pls. 19*).—A report on a test of 40 varieties of wheat grown two years in succession in the North and in the South Island. Each variety is briefly described and representative heads of all but 2 varieties are figured. A tabular statement of the results of the season 1899–1900 is given on page 253 of the same publication.

Wheat, J. S. Newman and J. S. Pickett (*South Carolina Sta. Bul. 56, pp. 12*).—The results of experiments reported in this bulletin indicate that introduced wheats ripen earlier as they become acclimated to the South, and that the acclimated varieties are to be preferred. One bushel of seed per acre gave the best results as compared with other quantities. Applying nitrate of soda when sowing the seed in the fall gave somewhat better results than its use as a top-dressing in spring. It was assumed that 600 lbs. of cotton seed and 200 lbs. of cotton-seed meal contain equal amounts of plant food, but when applied as fertilizer upon this basis cotton seed yielded an average of 2 bu. per acre more than the meal. Lime applied to the previous crop increased the yield on 5 plats by 1.55 bu. per acre. A plat plowed 6 in. deep yielded 8.4 bu. per acre more than a plat not plowed before sowing.

HORTICULTURE.

Horticultural division, F. W. CARD and G. E. ADAMS (*Rhode Island Sta. Rpt. 1900, pp. 247–267, figs. 5*). The horticultural work of the year has been along the lines of orchard culture, lettuce forcing, rhubarb growing, and experiments to test the frost resistance of plants and in the crossing and plant selection of strawberries. Some notes on the apple maggot and carnation-stem rot included in the report are noted elsewhere.

The second season's work in lightly fertilizing, cultivating and spraying with Bordeaux mixture and Paris green a neglected orchard (E. S. R., 12, p. 746) has given encouraging results and suggests the feasibility of making profitable by this method many of the neglected orchards of the State.

The frost resistance of three varieties of bush beans has been studied. The beans were grown in the hot bed. After they were well up the sash was removed and the plants exposed to frost on a cold night. Many of the plants were killed outright; others severely hurt, while a few showed little injury. Seed from these was saved and the plants subjected to similar treatment in the spring of 1900. The temperature in the neighborhood on the night of the exposure fell to 28° F. Again, a few plants remained uninjured. It is proposed to continue the work from year to year. Some of the resistant seed sown in the open field in comparison with ordinary seed showed more vigor in resisting cold and untoward conditions and made a stronger growth.

The pot experiments made in 1899 with lettuce to determine the profitableness of substituting commercial fertilizers for stable manure in the production of this crop (E. S. R., 12, p. 746) were carried out on benches in 1900. The soils used were garden loam and a mixture of one-third garden loam and two-thirds hotbed compost with clay added. Commercial fertilizers were added to the garden soil but nothing was used to lighten and improve its physical condition The result was a complete failure of the crop. On the stable manure plats the plants averaged 115.8 gm. each.

Before planting the second crop the stable manure plat was divided and boneblack and muriate and sulphate of potash applied to one-half. No additional fertilizers were applied to the garden soil but some 2 bu. of sphagnum moss was thoroughly incorporated with it. Again, the crop on the garden soil plat with the commercial fertilizers was practically a failure, while on the stable manure plat the crop averaged 151.2 gm. per plant when commercial fertilizers were added and 150.66 gm. without them. Before planting the third crop an attempt was made to improve the physical condition of the garden plats composed of soil and sphagnum moss by the addition of sand and a

thorough working over. The crop was improved considerably but still fell far behind the stable manure plat.

"It should not be inferred from these experiments that good lettuce can not be grown with chemical fertilizers but the experiments do indicate that it is more difficult to secure the requisite conditions and satisfactory results with chemicals than with stable manure, since the stable manure not only furnished apparently all the food needed for the production of three successful crops but what is probably more important it affords the requisite physical condition of the soil."

A further test of the value of commercial fertilizers was made under practical conditions on good lettuce soil in a commercial lettuce house at Auburn, R. I. A top-dressing of complete commercial fertilizers was compared with a top-dressing of manure. It is reported that "plants grown with top-dressings of chemicals did not start off so well as those receiving a top-dressing of manure but at harvest time they were superior, being decidedly heavier than those grown entirely with manure."

Some notes are given on the relative advantages of heating lettuce houses by means of stable manure and with coal. The latter is believed to be the cheaper method and more fully under the control of the grower.

In experiments in forcing rhubarb in cellars entirely devoid of artificial heat, the conclusion was reached that a warm cellar or one in which a little artificial heat is supplied is needed to produce rhubarb sufficiently early to make the practice desirable.

A record was kept during the season of the character and behavior of the plants in the strawberry field. A portion of the data are recorded. A remarkable variation in the yield of individual plants of the same variety occurred. With Beverly the highest yield per plant in grams was 285.8 and the lowest 34.5. Similar variations occurred with many other varieties. Usually plants giving the highest yields produced fruit equal to and in many cases above the average. The detailed yields of plants of 8 varieties chosen to be used in future plant selection experiments are shown in tabular form and the more successful crosses secured are noted.

Report on the substations, C. H. SHINN (*California Sta. Rpt. 1898, pp. 262-327, figs. 19*).—This report includes data on meteorology and the farm and orchard crops grown at the Foothill, Southern Coast Range, San Joaquin Valley, and Southern California culture substations. The fruits tested include apples, pears, almonds, apricots, nectarines, peaches, cherries, plums and prunes, figs, olives, walnuts, oranges and lemons, persimmons, quinces, mulberries, date palms, drawf and ornamental apples, and grapes. The farm crops grown were barley, wheat, saltbushes, grasses, clovers, and other forage plants, cotton, soy beans, cañaigre, etc.

In investigating the moisture content of hardpan soils at the Southern Coast Range Substation it was found that the uncultivated soil contained 2.6 per cent moisture, while cultivated orchard soil contained 3.3 per cent moisture. With the same rainfall, cultivated adobe soils (not hardpan) contained 12.3 to 16.1 per cent of moisture. Trees on the adobe soil made a growth of from 20 to 26 in., while those on the hardpan soils made growths of from 4 to 10 in.

A number of illustrations, with some data, are given, showing the value of gypsum in the reclamation of alkali lands at the San Joaquin Valley Substation.

At the Southern California Culture Substation a test was made of canning peaches. Six boxes of Yellow Tuscany Cling, California Cling, McDevitt Cling, Runyon Orange Cling, Sellers Cling, and Nichol Orange Cling were assorted and sent to a cannery and put through the process with the regular pack of other fruits supplied by local growers. At the end of the season the cans were opened and the fruit examined with reference to the appearance of the fruit as to color, absence of red at the pit, firmness of flesh, and clearness of juice. The results, as determined by the best local experts, were as follows:

"Sellers Cling and Yellow Tuscany stood first in firmness, absence of red at the pit, and color. Yellow Tuscany stood first in clearness of juice. . . . McDevitt Cling stood second in this respect, and the other clings were considered decidedly inferior to the above as canning peaches, not only in quality, but in firmness and appearance. California Cling had the greatest number of split pits; Nichol Cling and McDevitt came next in this regard. Sellers Cling was entirely and Yellow Tuscany was practically free from split pits."

Yellow Tuscany is considered a very productive variety. Lovell is regarded as the most promising of the yellow freestones for canning or drying.

Some experiments with self-pollenized olives were carried on at this station. Blossoms tied in paper bags failed to produce any fruit except in one or two cases, with medium sized olives. On a larger scale in the station orchard the value of mixing varieties was apparent.

As yet cotton has not proved a paying crop in southern California, where land and labor are so high priced.

California apples, G. E. Colby (*California Sta. Rpt. 1898, pp. 143–148*).—Physical, food, and ash analyses are given of 7 varieties of apples grown in different parts of the State. The largest apples and the ones richest in juice, sugar, and acid were grown in the high foothills and mountain localities. The percentage of sugar in whole fruit averaged 11.62, as compared with 8 to 9 per cent in eastern grown and European apples. So far as examined, the apple seems to withdraw much less mineral matter from the soil than any of the other orchard fruits (except pears), averaging only 0.264 per cent of ash in the whole fruit. The ash averaged over ½ potash and ⅛ phosphoric acid.

The following table shows the fertilizer ingredients contained in 1,000 lbs. of a number of California fruits and nuts:

Soil ingredients contained in 1,000 pounds of fresh fruit.

Fresh fruit (crop of 1,000 lbs).	Total ash.	Potash.	Lime.	Phosphoric acid.	Nitrogen.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Almonds	17.29	9.95	1.04	2.04	7.01
Apricots	5.08	3.01	.16	.66	1.94
Apples	2.64	1.40	.11	.33	1.05
Bananas	10.78	6.80	.10	.17	.97
Cherries	4.82	2.77	.20	.72	2.29
Chestnuts *a*	9.52	3.67	1.20	1.58	6.40
Figs	7.81	4.69	.85	.86	2.38
Grapes	5.00	2.55	.25	.11	1.26
Lemons	5.26	2.54	1.55	.58	1.51
Olives	13.50	9.11	2.43	1.25	5.60
Oranges	4.32	2.11	.97	.53	1.83
Peaches	5.30	3.94	.14	.85	1.20
Pears	2.50	1.34	.19	.34	.90
Prunes, French	4.86	3.10	.22	.68	1.82
Plums	5.35	3.41	.25	.75	1.81
Walnuts *a*	12.98	8.18	1.55	1.47	5.41

a Including hulls.

"The figures found for apples (and pears) are, on the whole, so much smaller than those which have been obtained for the other ordinary orchard fruits that it would seem safe to conclude that here fertilizers will not be necessary for apple crops for many years to come. However, the figures do indicate that the first need will be for a nitrogenous fertilizer, and this is about what this station has been led to recommend for most of our fruits. Along with this need will also come that for a phosphatic fertilizer. There is no reason to supply potash to apple orchards for a great many years to come. The rather high quantity of sulphuric acid in the ash of apples, like that of the ash of cherries and oranges, indicates the occasional need of a dressing of gypsum to the soil, which not only supplies the necessary sulphuric acid, but helps to make the potash present more available."

The condition of success with grafts, L. DANIEL (*Rev. Gén. Bot.*, *12* (*1900*), *Nos. 141*, *pp. 355–368; 142*, *pp. 405–415; 143*, *pp. 447–455; 144*, *pp. 511–529*).—The author reviews the earlier beliefs respecting conditions necessary for the successful grafting of plants on each other, defines certain terms used in grafting, and gives the conditions necessary for success in grafting a large number of plants belonging to different species, genera, and families.

Grafts are divided into two groups—grafts by approach, or anatomical grafts, and true or physiological grafts. The graft properly called, or physiological graft, is divided into two classes—ordinary grafts and mixed grafts. There is an ordinary graft proper when the stock is deprived entirely of its assimilating apparatus and the scion of its absorbing apparatus. In the mixed graft proper the stock may preserve part or all of its assimilating apparatus, and the scion part or all of its absorbing apparatus. In grafting by approach success is considered to be attained when the two plants grow together in an enduring manner, so that if separated a wound is formed. The graft proper is said to succeed when after having lived a certain length of time on the stock the scion fructifies and produces fertile seeds.

The conditions of success of grafts are divided into two groups, extrinsic conditions, *i. e.*, conditions independent of the nature of the plant, as soil, temperature, etc., and intrinsic conditions, or conditions dependent upon the peculiar nature of the plants grafted, as method of cicatrization, analogy, and botanical relations. The extrinsic conditions which it is necessary to observe in grafting by approach are summarized as follows: (1) A temperature sufficient for the production of the meristem, (2) the prevention of all conditions which cause rotting or drying of the cicatrizing meristem, and (3) maintenance of adherence of the wounds by the aid of ligatures susceptible of being loosened progressively with the growth of the plant.

Under intrinsic conditions in grafting by approach cicatrization is first considered. Plants cicatrize their wounds either by simple drying of the cut tissues and neighboring cells or by regeneration of tissues by the aid of the meristem. The author thinks it may be possible to graft plants by approach which cicatrize the wound by drying up, but this could be accomplished only by compression when operating with very young tissue in a way to produce an artificial concrescence. This last method has not been tried, but all methods by cutting have failed in the divers monocotyledons and the majority of the cryptogams. Thus the author has not been able to graft Ruscus, ferns, bamboos, or maize, and hence formulates the fourth fundamental condition of success in grafting by approach as follows: Grafting by approach is impossible with all plants which cicatrize their wounds by desiccation of the wounded cells and neighboring tissues—that is to say, are incapable of regenerating their tissue.

In order to learn whether only plants possessing cambium tissue are able to be grafted, as generally held, the author operated on a number of monocotyledons and cryptogams. A perfect cicatrization of the wound was obtained by the tongue graft with Gladiolus, *Funckia cordata*, day lily, *Philodendron*, caladium, white lily, *Globba coccinea*, etc., but the most interesting result was the success of the cicatrization of *Selaginella arborea*. The success of these grafts shows that grafting by approach is possible with certain monocotyledons, and that the presence of the cambium layer is not always necessary to the success of all grafts by approach.

Under analogy in grafting by approach, plants essentially different in wood and bark structure are first considered. Borecole and turnip, the structure of which is very different, were easily grafted, forming a perfect suture between the ligneous layer of the borecole and the medullary parenchyma of the turnip. The difference in the hardness of woods and their histological nature may not be an obstacle to anatomical union. A natural, distinct cicatrization occurred between the grafted oak and the beech and between the fir and linden; the oak and the ash united by their stems, and the oak and the walnut united

by their roots. The rose and the grape have also been united. Nevertheless, the graft by approach does not always succeed between plants so different. Thus the author endeavored in vain to graft the horse-chestnut and the common chestnut.

The author considers analogy in cell contents as affecting the graft by approach, and it is shown that the accumulation of reserve material in different vegetative parts of plants has no special importance in grafting, as is proved by the success attained in grafting by approach the turnip and cabbage, borecole and kohl-rabi, Brussels sprouts and kohl-rabi, and kohl-rabi and cauliflower. Even grafting by approach between roots of lettuce and aged salsify succeeds, though the inulin of the salsify roots is not able to circulate in the cell membrane of the lettuce. But if the cell contents of one of the plants approached are toxic for the other, the graft fails. Thus the author was not able to graft celandine and salsify, salsify and burdock, etc.

Under analogy in method of development, it is shown that if a large and a small variety are grafted on each other, the larger variety will develop to the detriment of the smaller, which will remain nearly dwarf. Plants of different forms, like borecole and cauliflower, may make good unions. Plants in active condition of growth may be grafted by approach on plants at rest. Thus a seedling cabbage several weeks old was grafted in the spring time on a turnip, the root of which was already completely formed. The graft succeeded perfectly. The graft by approach succeeds between annuals, biennials, and perennials. Thus peas, sweet peas, and toad flax have been united. The symbiosis ceased at the death of the annual species. The same fact was observed in grafting by approach biennial and perennial plants. The success of the graft between the fir and the linden, and *Aralia spinosa* and *A. sieboldii*, shows that deciduous and evergreen plants may be grafted on each other.

With the graft proper, as with the graft by approach, all of the extrinsic conditions, such as temperature, rotting and drying of the meristem, and necessity of contact of the wounds, are present, but in cutting off the top of the stock and suppressing the absorbing apparatus of the scion there is danger of the death of both plants. Another fundamental extrinsic condition of success, then, must be the maintenance of the life of the two plants until success is complete. The scion is sometimes preserved by placing it in water as soon as it has been prepared. This prevents it from drying out, keeps the cut surface clean, and prevents the formation of sugar or other materials on the cut ends which might interfere with the free passage of sap from stock to scion, and is recommended.

In order that the scion may be able to grow, it is necessary to reestablish the turgescence of its tissues. This reestablishment is made by imbibition of the crude sap of the stock by the cells of the scion. The

reestablishment of turgescence is effected more quickly according as the crude sap is presented in considerable quantity, but also more quickly if the initial turgescence of the tissues of the scion has not been diminished during the preparation of the graft and its putting in place. This explains why it is necessary to operate quickly and why the cutting of the graft under water, where the scion preserves in a large part its turgescence, produces such good results. It also accounts for the good effects of the waxlike material in grafting in the open air; the utility of the collar graft, because the osmotic force is strongest at this level; and the importance of the time of day in operating, because the osmotic force varies in the course of the day, being strongest in the evening (hence the greater success of grafting in the evening). The reestablishment of the turgescence in the graft is cited as a fundamental condition of success, therefore it is not possible to graft parts of plants which are incapable of retaking their turgescence or which do not possess it entirely.

Under intrinsic conditions, it is shown that in the graft proper, as in the graft by approach, plants incapable of regenerating their tissues can not be grafted. The author succeeded in grafting by the graft proper the white lily, Gladiolus, *Funckia cordata*, etc., when operating on young stems. In all these grafts the anatomical cicatrization was effected by the parenchymatic tissues. No liber or fibrovascular structure was observed to form between scion and stock. The transport of the sap was thus singularly hindered, and at the end of a variable period one of the parts, or both, died. By utilizing the aerial roots, which some of the monocotyledons possess, to supplement the absorption of the scion, success was attained with a number of plants. This shows that the nonsuccess of the graft with monocotyledons capable of regenerating their tissues comes from insufficient vascular communication, since it becomes possible when a complementary absorption apparatus is supplied.

Plants with active cambium layers, which may be grafted by approach, can not always be grafted by the graft proper, since the common European bean (*Faba vulgaris*) and the kidney bean, which graft easily by approach, have always failed when grafted by the graft proper, no matter what precautions were taken.

Differences in wood and bark are not obstacles to success in the graft proper. Thus there is a great difference in the thickness and strength of the safflower and the annual sunflower; between the sunflower and the Jerusalem artichoke; the young cabbage and the root of the turnip; the root of the cultivated carrot and that of fennel; nevertheless, these plants united perfectly. These same facts were observed with trees, the graft succeeded between the chestnut and the oak, the pear and the hawthorn, the hawthorn and the quince, in spite of the marked differences in the barks. From these and other grafts, it is concluded

that hardness, density, and elasticity of wood play a secondary rôle in the success and duration of grafts, but it is not the same with conduction. When the differences of sap conductions are too great the grafts will not succeed. As an example may be mentioned the grafts between the lilac and ash, cherry and almond, cotoneaster and chestnut, etc., which grow the first year, then die without fructifying. The duration of the graft is then very variable and depends for its value on the differences in conduction between the scion and the stock. Thus the pear grafted on the quince endures for a shorter period than the pear grafted on the pear seedling. When the differences of conduction are too great between two plants, the mixed graft is sometimes used successfully where the ordinary graft fails. By the use of the mixed graft the author was able to unite *Vernonia prœalta* and *Xanthium macrocarpum*, which failed by the ordinary process of grafting.

The author has succeeded in grafting plants whose cell contents presented very marked differences. Thus the grafts of Chicoriaceæ and of divers Euphorbiaceæ, etc., show that plants with different latex contents succeed, although it has been previously held that plants with a milky juice could not be grafted.

A number of grafts were made to determine what influence reserve material in plants might have on grafting. The easy grafts on roots of the carrot and parsnip show that the presence of reserve material is no obstacle to success. The graft of the tomato on the potato, annual sunflower on the Jerusalem artichoke, etc., show that the formation of tubers on the stock takes place even when the scion is incapable of producing tubers itself. In grafting in September a young cabbage on the purple-topped turnip, which would have commenced to form its tuber in October, the turnip tuber formed only the month of April following, when the scion became plethoric. It is then the scion which by its mode of nutrition commands the function of reserve material in the stock.

The inverse graft of plants susceptible of forming tubers on a plant which does not yield tubers may be realized. Thus the author succeeded in grafting *Helianthus latiflorus*, species with enlarged rhizome, on *H. annuus*, an annual species not forming tubers. The scion grown entirely above the soil was unable to form tubers. The reserves which were formed passed into another form in the stock, which took a development altogether abnormal and became very ligneous. The potato grafted on eggplant and tomatoes has been observed to form aerial tubers and thus store up its reserve material.

Analogy in habitat seems to be a more or less important factor. Thus *Phlox decussata*, which grows in humid soils, has not been successfully grafted by the author with *P. subulata*, which grows on dry soils; though parsley, which prefers a dry soil, succeeds when grafted with *Sison ammomum*, which prefers a humid soil. In the case of trees,

pears are grafted on quince in rich soil and on pear seedlings in poor soil, etc. Different soils then are not the most serious obstacles to success in grafting, but they seem to have more or less marked influence on the duration of the graft.

If a dormant ligneous scion is grafted on an active ligneous stock, success follows, but does not follow if conditions are reversed. With herbaceous plants, an active scion may be grafted on a dormant stock and succeed. When the scion and stock do not come into activity about the same time, the graft may succeed, but the duration of the graft will be shortened.

In order to study the limits of the possibility of grafting, experiments were made with the following families of plants: Rosaceæ, Umbelliferæ, Leguminosæ, Cruciferæ, Solanaceæ, and Compositæ. With Rosaceæ, Leguminosæ, and Cruciferæ, the limit of grafting seems to be confined to genera of the same tribe. With Solanaceæ and Umbelliferæ, grafts were successfully made between different tribes. With Compositæ the limit of grafting seems to be the subfamily.

Horticulture from an educational standpoint, F. W. CARD (*Rhode Island Sta. Rpt. 1900, pp. 268–276*).—A popular essay on this subject.

The principles of vegetable gardening, L. H. BAILEY (*New York: Macmillan Co., 1901, The Rural Science Series, pp. 458, figs. 114*).—A popular, comprehensive treatise on various phases of gardening operations and the culture of all the more usual vegetables. Part I contains chapters on the lay-out of the plantation, use of glass, the soil and its treatment, vegetable gardening tools, seeds and seedage, subsequent management of the vegetable garden, marketing, and storing. Part II discusses vegetable gardening crops. These are classified into root, tuber, bulb, cole, pot herb, salad, pulse, solanaceous and cucurbitous crops, sweet corn, okra, martynia, condimental and sweet herbs, and perennial crops. The work also contains a bibliography of over 100 American works on vegetable gardening. Not the least valuable features of the work are extensive illustrations of gardening tools and of seedling plants of all the more common vegetables.

Greenhouse production of market garden crops, W. W. RAWSON (*New Jersey State Bd. Agr. Rpt. 1899, pp. 179–196*).—Brief notes on greenhouse construction and on the forcing of asparagus, beets, beans, cauliflowers, cucumbers, dandelions, lettuce, parsley, rhubarb, and radishes.

Asparagus culture, J. J. T. NORFOLK (*Jour. Roy. Agr. Soc. England, 3. ser., 11 (1900), pt. 4, pp. 646–652*).—Popular directions for growing lettuce in the field, garden, and greenhouse in England.

Keeping quality of Prizetaker onion (*Amer. Gard. 22 (1901), No. 319, p. 76*).—In the experience of the author the keeping quality of this onion has been made equal to that of any other variety by the liberal use of available potash.

Fertilizer test with sweet potatoes, B. W. KILGORE, R. W. POU, and A. H. PRINCE (*Bul. North Carolina State Bd. Agr., 21 (1900), No. 11, pp. 38–42, figs. 2*).—Report of an inconclusive test of various fertilizer elements and combinations for sweet potatoes. Yellow Nansemond and Bunch Yam were the best varieties grown.

Edible and poisonous mushrooms and toadstools, W. TRELEASE (*Missouri State Hort. Soc. Rpt. 1900, pp. 224–241*).—Besides general notes and descriptions, a bibliography of 48 papers is given.

Preservation of beans in brine, ZSCHOKKE (*Jahresber. Vers. Stat. u. Schule, Wädensweil, 1897–98, pp. 41, 42*).—In an experiment in the preservation of string

beans in brine 10 kg. of green beans (seeds and pods) were put in one crock, 10 kg. of slightly steamed beans in another, and 10 kg. of beans steamed until they were soft, in a third. In each case the beans were stringed. The crocks were lined with full-grown grape leaves, and the beans covered with the same and with cheese cloth. Each crock was salted alike, 50 gm. of salt being used for each kilogram of beans. The beans were kept under brine by means of a weighted cover. After 4 to 4½ months, the crocks were opened. In each crock the beans were of a good green color and the quality equally good. The pods were slightly tougher where they had been salted without steaming. The author believes that in keeping beans in brine most satisfactory results are obtained if the beans are first steamed, quickly cooled off, and then salted in the crocks cold. When beans are salted without steaming, only the young pods should be taken.

First annual report of the board of trustees of the Missouri Fruit Experiment Station (*Rpt. Bd. Trustees Missouri Fruit Expt. Sta. 1900, pp. 20*).—Report of progress on buildings and orchard setting, with a financial account for the year. Bitter rot and apple scab were largely controlled by spraying with Bordeaux mixture.

Fertilizing peaches and other crops, B. TYSON (*Amer. Gard., 22 (1901), No. 319, p. 76*).—Suggestions as to methods and amounts of fertilizers to use for peaches and wheat.

Japanese plums, G. S. BUTLER (*Trans. Massachusetts Hort. Soc. 1900, pt. 1, pp. 102–110*).—Cultural suggestions, with descriptions of a few varieties and notes on synonyms.

Japan plums, H. O. MEAD (*Rural New Yorker, 60 (1901), No. 2664, p. 103*).—The essential principles of culture are given in condensed form and represent the experience of the author for 15 years. A high, fairly dry location, and one-year trees 4 to 5 ft. high budded on peach stock, and planted 13 to 16 ft. apart are recommended. Early potatoes and berries can be grown in the orchard the first year or so without harm, after which the orchard should be cultivated and a humus crop grown each year to turn under. The plums must be thinned. Fertilizers with not too much nitrogen, a fair amount of phosphoric acid, and plenty of potash are advised.

Information on coffee in Costa Rica (*Estudio é informe sobre el café de Costa Rica. San José: Government, 1900, pp. 48*).—Of a commercial nature and containing analyses of several samples of coffee.

American vines for the reconstruction of French vineyards; description of the principal varieties of stocks and direct producers, J. GRANDVOINNET (*Les cépages américains pour la reconstitution du vignoble français; description des variétés principales porte greffes et producteurs directs. Paris: Octave Doin, 1900, pp. 108, figs. 70*).—Nearly 50 species and varieties of American grapes are described. Natural size illustrations of the leaves of the different varieties are given, and the adaptibility of the vines to different soils and their resistance to the phylloxera are noted.

Tests of chemical fertilizers on grapes in 1900, E. CHUARD and C. DUSSERRE (*Chron. Agr. Canton Vaud, 14 (1901), No. 2, pp. 29–38*).—This is an account of cooperative experiments carried out by the viticultural station of the Canton of Vaud to test the desirability of substituting commercial fertilizers for half the barnyard manure usually employed in fertilizing grapes. The results show the practice to be economical and desirable.

Making a cranberry bog (*Rural New Yorker, 59 (1900), No. 2656, p. 847*).—Notes on methods of preparing and utilizing swamps and details of planting and harvesting the crop.

Chestnut farming in Pennsylvania (*Rural New Yorker, 60 (1901), No. 2663, p. 82*).—An account of a weevil-free orchard grafted on chestnut stump saplings with selected wild chestnuts. The orchard is located high up on the mountains. The selected nuts are very large—nearly, if not quite, as large as Paragon nuts—and the quality is equal to small native sweet varieties.

India rubber, gutta-percha, and balata, W. T. Brannt (*Philadelphia: Henry Carey Baird & Co., 1900, pp. XXIV + 328, figs. 24*).—Discussion of the "occurrence, geographical distribution, and cultivation of rubber plants; manner of obtaining and preparing the raw materials; mode of working and utilizing them, including washing, loss in washing, maceration, mixing; vulcanizing rubber and gutta-percha compounds and utilization of waste; balata and statistics of commerce."

The caoutchouc plants and their culture, O. Warburg (*Die Kautschukpflanzen und ihre Kultur. Berlin: Kolonial-wirtschaftliches Komitee, 1900, pp. 154, figs. 11*).—This work purposes to sum up and critically examine the many detailed observations on caoutchouc plants, the object being to give a true idea of these plants, their culture, etc. The first chapter treats of caoutchouc production and consumption, thus giving a general idea of the commercial importance of the subject in different countries.

Gums, resins of exotic origin, and vegetables which produce them, particularly in the French colonies, H. J. de Cordemoy (*Gommes, resines, d'origine exotique, et végétaux qui les produisent, particulierment dans les colonies françaises. Paris: Augustin Challamel, 1900, pp. 312, figs. 47*).—The work is divided into 3 parts. Part 1 defines, gives the general properties, and describes a large number of gums and the trees producing them. In the same manner, part 2 treats of resins and part 3 of resin-gums.

The cultivation of medicinal plants (*Amer. Gard., 22 (1901), No. 319, pp. 73, 74*).—Summarized suggestions of H. H. Rusby, College of Pharmacy, New York City, regarding the probable profits in growing a number of medicinal plants.

The improvement of the carnation in America, C. W. Ward (*Trans. Massachusetts Hort. Soc. 1900, pt. 1, pp. 91–101, pls. 6*).—Historical notes, brief description of the process of hybridizing carnations, descriptions of a number of prominent American varieties with illustrations, and some statistics concerning the magnitude of the carnation industry in the United States.

Groff's hybrid gladioli, M. Crawford (*Amer. Gard., 22 (1901), No. 322, pp. 131, 132*).—The requirements of a standard gladiolus are set forth and Groff Hybrid shown to compare favorably with it.

Rose growing under glass, T. Price (*Amer. Gard., 22 (1901), No. 321, pp. 111, 112, fig. 1*).—Popular directions for soil, planting, watering, ventilation, supports, propagation, and varieties, with notes on insects and diseases of roses.

On the cross-fertilization or hybridization of roses, S. Mottet (*Rev. Hort., 73 (1901), No. 3, pp. 67, 68; transl. in Amer. Gard., 22 (1901), No. 327, pp. 227, 228*).—Details of methods.

Water lily pond, G. Abbey (*Jour. Hort., 53 (1901), No. 2729, pp. 49–51, figs. 2*).—An illustrated outline plan with lists of suitable plants.

Distribution of seeds, plants, cuttings, etc., E. J. Wickson (*California Sta. Rpt. 1898, pp. 233–236*).—Summarized statement of the amount and kinds of seed distributed by the central experiment station since 1886, with financial statement regarding the same for the 6 years ended 1899.

FORESTRY.

Report of the forestry substations, C. H. Shinn (*California Sta. Rpt. 1898, pp. 328–351, figs. 7*).—A report is given of the history and present condition of the forestry substations located at Chico and Santa Monica. The Chico forestry station was originally a part of the Chico ranch, which formerly belonged to General John Bidwell. The previous owner began collecting the native and finer exotic trees as early as 1856, and notes are given on the present growth of a num-

ber of the finer specimens. Numerous specimens of *Pinus sabiniana* and *P. ponderosa* are now more than 100 feet in height, with trunks from 8 to 11 feet in circumference. Specimens of *Sequoia gigantea* and *S. sempervirens* are from 80 to 90 ft. in height and from 4 to 5½ feet in circumference. A native cottonwood planted in 1856, at the time of this report was 100 ft. high and the circumference of the trunk was 16 ft. Notes are given on the present size of a number of other species. The climatic conditions shown by records kept at the station since 1885 are given, together with notes on the more recent additions to the arboretum. Statistics are given on the rate of tree development in which are shown the rate of growth of a large number of coniferous and deciduous trees. Experiments have been conducted on the planting of various oaks, principally the English oak (*Quercus pedunculata*). The results obtained seem to indicate that in the central Sacramento Valley the planting of oaks for timber might prove profitable. Next to the oaks, different varieties of ash promise the best results as hard wood forest trees. An account is given of the willow collection at the Chico Station, in which the characteristics and rate of growth of the 15 best species are shown. Descriptive notes are also given on a number of species of Eucalyptus and Acacia at the Chico Station.

Among the more interesting statements regarding the Santa Monica Station are the notes showing the effect of drought on different trees. The deficient rainfall for two successive years served to indicate the more hardy species of trees adapted to that region. A list is given of 60 species of the Eucalyptus in cultivation at the Santa Monica Substation in 1899. Illustrative and descriptive notes are given on a few species of Eucalyptus, Acacia, and other trees.

Forest reserves, H. GANNETT (*Twentieth Ann. Rpt. U. S. Geol. Survey, 1898–99, pt. 5, pp. 498, pls. 159, figs. 2*).—This report contains a review of the forests of the United States, by the author, together with detailed reports on some of the forest reserves in the western United States. Descriptions are given of Pikes Peak, Plum Creek, and South Platte reserves, by J. G. Jack; the White River Plateau and Battlement Mesa reserves, by G. B. Sudworth; the Flathead Forest Reserve, by H. B. Ayers; and the Bitterroot, San Gabriel, San Bernardino, and San Jacinto reserves, by J. B. Leiberg. During the year covered by this report 11,000 square miles were added to the forest reserves, the present area devoted to that purpose being 72,139 square miles. This area is composed mostly of mountainous, rugged country, of little or no value for agriculture, but especially favorable to tree growth. Abstracts are given of the reports on different forest reserves, in which the area, the general condition, and permanent species of trees are described. The relationship of forest fires and grazing to forest problems is discussed by the different authors at some length.

The forest nursery, G. B. SUDWORTH (*U. S. Dept. Agr., Division of Forestry Bul. 29, pp. 63, pls. 5, figs. 11*). The purpose of this bulletin is to inform farmers and others interested in tree planting how to procure forest tree seeds, and raise seedlings at a small cost. The principal point kept in view is to direct the propagator to produce vigorous plants which will succeed best under inexperienced management. The desirability of cooperation among the farmers of a locality is pointed out as a means by which larger privileges of seed and plant exchange are possible. Notes are given on collecting tree seeds and their care before planting. Suggestions are given of when and how to collect the seeds, and methods for storing, and for testing their vitality. Directions are given for the propagation of trees of various kinds from seeds and cuttings, and means to be adopted in wintering and transplanting seedlings. As cheap sources of supply the author recommends the use, so far as possible, of wild seedlings. The bulletin concludes with lists of useful timber trees for planting, in which notes are given of their range, the appearance and character of their fruits and seeds, the time to collect and use them, and methods of storage.

The Minnesota forestry plan, J. N. CROSS (*Forester, 6 (1900), No. 11, pp. 263-266, pls. 2*). The efforts on the part of various societies and boards to secure forest legislation are briefly reviewed. By means of an educational system in which the newspapers were interested in the project, a sentiment was aroused which finally resulted in the passing of needed legislation.

Under the law creating the State Board of Forestry, it is provided that any person having denuded or other lands worthless for agricultural purposes may deed them to the State, and, upon acceptation, the State undertakes to protect these lands from fires, exempt them for taxation, and, to a certain extent, reseed them so as to render them useful and profitable. Any income realized from these forests is divided into three parts and distributed as follows: One-third is retained to reimburse the State for fire protection, etc.; one-third goes to the educational system of the State; and the remainder to the donor, his heirs, or to whomsover he may designate.

Under the terms of this law a number of persons have tendered lands to the board and a start has been made. Four years have elapsed since the plan was begun and beneficial results are believed to have been secured.

The forests of Saxony (*Indian Forester, 26 (1900), No. 9, app. pp. 1-15*).—The forest area of the Kingdom of Saxony is said to represent 27.4 per cent of the total area. This is divided into State, communal, and private forests. Descriptions are given of the State forests in which for the 5 years ended in 1891 the revenue amounted to 45.5 marks per hectare. There are in Saxony 108 forest ranges, averaging 1,620 hectares each. The working plans for a number of these ranges

are given. A number of the more important forest districts are described in some detail. The prevailing species in these forests are spruce, followed by beech and fir. The Crottendorf range, which is said to be remarkable for the large profit it yields, is described at considerable length. The net revenue from these forests for the past 10 years has been 121.9 marks per hectare, which represents 4.35 per cent of the estimated value of the range. In some of the forests considerable damage has been done to young spruce trees by the fungus *Trametes radiciperda.*

Forests in the Grand Duchy of Baden (*Indian Forester, 26 (1900), No. 9, app. pp. 125, figs. 14*).—The forests of the Grand Duchy of Baden are said to occupy a total of 36.2 per cent, as compared with an average of 26 for the whole of Germany. This area is divided into State forests, 95,000 hectares; forests belonging to towns, villages, and other public corporations, 270,000 hectares; and private forests, 180,000 hectares. Of these forests, the beech occupies 26.4 per cent of the total forest area; oak 11.1 per cent; other broad-leaved species 14.1 per cent; while spruce occupies 20.8 per cent; silver fir and Scotch pine each 13.6 per cent; and other conifers 0.4 per cent. The methods of treatment followed within the Grand Duchy are described and grouped under the heading of high forest and coppice. The methods of administration are described and working plans for a number of State forests are given. The method pursued in charcoal burning is described at considerable length.

The protection of shade trees in towns and cities (*Connecticut State Sta. Bul. 131, pp. 30, pls. 9*).—This bulletin is the report of a committee appointed by the mayor of the City of New Haven, Conn., to investigate the subject of the protection of shade trees. The present condition of the street trees was indicated and various causes of the destruction of trees were mentioned. Suggestions are given for protecting shade trees against these injuries, and the duties of the city forester are outlined. The necessity for a nursery to provide shade trees for those which have been destroyed from various causes is shown, and descriptions given of the varieties of trees most suitable for street planting.

Concerning a severe injury to street trees through the escaping of illuminating gas, C. WEHMER (*Ztschr. Pflanzenkrank., 10 (1900), No. 5, pp. 267–269, pl. 1*).—An account is given of the severe injury to a number of trees of *Ulmus campestris.* The injury was caused by a break in a gas main, and it was communicated to the trees through their roots. The bark fell off, the trunks of the trees showing the injury early in the spring, while the buds and twigs appeared in normal condition.

Some unrecognized forms of native trees, S. COULTER (*Proc. Indiana Acad. Sci. 1899, pp. 112–116*).—Brief descriptions are given of a number of well-marked forms of native trees which the author thinks possibly worthy of varietal rank. Among those described are two forms of the papaw which are said to be easily distinguishable. One has a large fruit, which becomes a rich yellow upon ripening; the other has a small fruit, becoming white when ripe. The leaf characters are also different. Three easily distinguishable forms of black walnut are also described, and forms of the common tulip tree and persimmon are also said to exist, in which marked characters may be noted.

Larch culture, F. Baudisch (*Oesterr. Forst u. Jagd Ztg., 18 (1900), No. 35, pp. 275, 276*).—Directions are given for raising larches and their principal insect and fungus enemies are described. Among the latter, *Peziza willkommii, Sphærella laricina,* and *Allescheria laricis* are said to be the most troublesome, especially to the young seedlings. Suggestions are offered for combating them.

The larch and its culture in Middle and Northern Germany, F. Boden (*Die Lärche ihr leichter und sicherer Anbau in Mittel- und Norddeutschland. Leipsic: T. Fuendling, 1900, pp. 140, pls. 3; abs. in Ztschr. Forst u. Jagdw., 32 (1900), No. 10, pp. 636–638*).—Some of the problems of larch growing are discussed and especial attention given to the diseases and insects to which it is subject. *Peziza willkommii* is said to be the most serious enemy to its successful propagation.

The white pine in North America, Schwappach (*Ztschr. Forst u. Jagdw., 32 (1900), No. 10, pp. 599–604*).—A review is given of Bulletin 22 of the Division of Forestry of this Department (E. S. R., 11, p. 746).

Pinus cembra and its cultivation, A. Woditschka (*Oesterr. Forst u. Jagd Ztg., 18 (1900, No 21, pp. 163–166, figs. 11*).—Describes the distribution and uses of this pine and gives suggestions for its culture.

Transplanting of large oaks, Hinderlich (*Gard. Chron., 3. ser., 28 (1900), No. 716, p. 203, fig. 1*).—An account is given of the successful transplanting of 87 oak trees ranging in size from 19 to 34 ft. in height.

Physiological differences between the sessile and pedunculate oaks, W. R. Fisher (*Gard. Chron., 3. ser., 28 (1900), No. 717, pp. 218–220, figs. 2*).—Differences between *Quercus sessiliflora* and *Q. pedunculata* are noted. These two species were formerly considered by English botanists as forms of *Q. robur. Q. sessiliflora* delights in dry, well drained soil, while the other grows best in moist soils. Differences are noted for the foliage, flowers, and timber. The fact that numerous hybrids between the two species are common is given as the reason for believing they both belonged to the same species.

Observations and experiments at the Krapiva forestry school during the academic year 1898–99, V. Kluchnikov (*Selsk. Khoz. i Lyesov., 197 (1900), Apr., pp. 207–224*).—During the reported year experiments in storing acorns by various methods were made. It is stated that the fungus *Polyporus sulphureus* attacked the oak, a very rare phenomena.—P. FIREMAN.

The green alder and forest protection, A. Mathey (*Rev. Eaux et Forêts, 3. ser., 4 (1900), No. 12, pp. 353–359*).—The value of this coppice wood as protective against landslides and avalanches is shown. Its rapid growth is described and it is said to be a good nurse crop for spruce.

Practical forestry in the Adirondacks, B. E. Fernow (*Tradesman, 44 (1901), No. 9, pp. 112, 113*).—An account of the work of the Cornell School of Forestry, etc.

Notes on some timber trees of the Burnett District of Queensland, V, J. W. Fawcett (*Queensland Agr. Jour., 7 (1900), No. 3. pp. 271–274*).—Brief descriptive and economic notes are given on 28 species of timber trees.

The trees of Java, VI, S. H. Koorders and T. Valeton (*Meded. 'S Lands Plantentuin, 1900, No. 40, pp. 1–193*).—Descriptions and economic notes are given on the trees of Java belonging to the orders Bixaceæ, Lecythidaceæ, Myrsinaceæ, and Myrtaceæ.

The development of forestry in Japan, H. Matzuno (*Ztschr. Forst u. Jagdw., 32 (1900), No. 7, pp. 406–412*).—Traces the development of forestry and establishment of forest control under the government.

The value of commercial fertilizers in reforesting, A. Felber (*Deut. Landw. Presse, 27 (1900), No. 98, pp. 1172, 1173, figs. 4*).

Forestry at the Paris Exposition of 1900, J. S. Gamble (*Indian Forester, 27 (1901), No. 1, pp. 1–24*).—Brief notes are given descriptive of the forestry exhibits and display at the Paris Exposition of 1900.

SEEDS—WEEDS.

Clover seeds and their impurities, F. H. HILLMAN (*Nevada Sta. Bul. 47, pp. 90, figs. 92*).—Extended series of studies on clover seeds and their impurities are reported. The author has investigated a number of kinds of clover seed and separated from them the different kinds of weed seeds occurring in them. The characteristics of the different clover seeds are figured and described and lists given of the kinds of weed seeds and percentages found in the different samples containing them. Studies are given of alfalfa seed, red clover, white clover, alsike clover, crimson clover, Japan clover, Bokhara clover, yellow sweet clover, yellow trefoil, esparcet, and serradella. From 4 to 90 samples of each of these seeds were examined. The most common weed seeds were *Plantago rugelii*, *P. lanceolata*, *P. aristata*, *Chamæraphis viridis*, *C. glauca*, *Polygonum persicaria*, *Chenopodium album*, *Rumex crispus*, *R. acetosella*, and *Euphorbia nutans*. The different weed seeds are figured and described in considerable detail.

Experiments in preserving forest-tree seeds (*Bul. Soc. Cent. Forst. Belg., 7 (1900), No. 7, pp. 514–519*).—Experiments are reported with acorns and chestnuts, in which the relative efficiency of autumn and spring planting is compared. The autumn plantings were made in two lots, in one of which the acorns were covered with leaves to a depth of from 5 to 6 cm., while in the other they were planted in trenches to a depth of 0.1 meter or a little less. The seeds for spring plantings were preserved as follows: In trenches, in piles covered with soil and others covered with leaves, in baskets submerged in water, and stratified in sand in a dry cave. The results, as shown by the germination and growth of the different lots, are tabulated, from which it appears that in a sandy loam during an ordinary winter autumn seeding is preferred to any of the methods of preserving the seed and planting in the spring. This is shown not only by the fact that more germinations were obtained, but that the work could be done at a season of the year when there was less demand for attention to the nurseries, as is the case in the spring of the year.

The effect of hydrocyanic-acid gas upon the germination of seeds, C. O. TOWNSEND (*Proc. Amer. Assoc. Adv. Sci., 48 (1899), p. 297*).—Seeds in both a dry and damp state were tested with different strengths of gas and for different periods of time. In the case of dry grains and seeds it was found that they were able to withstand for several weeks an atmosphere of hydrocyanic-acid gas many times stronger than that required for the destruction of insect life. Under these conditions a slightly accelerated germination was observed, and the subsequent growth of the seedlings was slightly above normal. Seeds that had been soaked in water were very sensitive to the presence of the gas. Three one-hundredths of a gram of potassium cyanid per

cubic foot used in generating gas, destroys the germination of seeds that have been soaked for 24 hours in water. The resistance of seeds to this gas seems to be somewhat in proportion to the length of time in which they had been previously soaked.

The germination of ripe and half-ripe dodder seed, W. KINZEL (*Landw. Vers. Stat.*, *54* (*1900*), *No. 1-2*, *pp. 125-132*).—Studies are reported upon the germination of seed of various degrees of ripeness of *Cuscuta epilinum*, *C. epithymum*, *C. planiflora*, and *C. europaea*. It was found that the half-ripe seeds of these species retained sufficient vitality to germinate almost as readily as the fully ripe seed. In some cases they germinated quicker than ripe seeds, and when they were found in their capsules the percentage germination was but little inferior to well-ripened seed. The author says that *C. planiflora* is occasionally found in American clover seed. This seems to be a misstatement, as that species does not appear in any of the recent systematic treatises of the flora of this country. The species is a south European one and its reputed presence is probably due to a wrong determination.

Destruction of weeds in fields of cereals, C. DUSSERRE (*Ann. Agr. Suisse*, *1* (*1900*), *No. 9*, *pp. 331-337*, *figs. 4*).—An account is given of a number of experiments in which oat fields were sprayed with different strengths of solutions of copper sulphate, iron sulphate, and sodium nitrate, together with mixtures of copper sulphate and sodium nitrate. The best results, so far as weed destruction was concerned, were obtained where the fields were sprayed with a 5 per cent solution of copper sulphate, followed closely by spraying with a 2 per cent solution of copper sulphate and a 10 per cent solution of sodium nitrate. The influence on the oat crop showed a decided stimulating effect where the combination of the copper and soda was employed. The weeds destroyed were mustard, sow thistle, hemp nettle, bindweed, dock, and various chenopods. Directions are given for the proper application of these herbicides, which should be applied at the rate of 800 to 1,000 liters per hectare. The spraying should be made on a calm, clear day, and should not be delayed beyond the time when the weeds have their first two or three leaves.

Report on seed testing at the agricultural station of Modena for the year 1899, F. TODARO (*Staz. Sper. Agr. Ital.*, *33* (*1900*), *No. 3*, *pp. 238-258*).—A report is given on the activity of the station during the year in testing seeds, and the purity, germinative ability, and intrinsic value of the different samples are shown in tabular form. The principal weed seeds found in a number of different samples are mentioned, and special studies on a number of kinds of seed described.

Seed testing, T. W. KIRK (*New Zealand Dept. Agr. Rpt. 1900*, *pp. 299-303*).—A tabulated statement is given showing the percentage of germination obtained with the samples tested. While slight improvement in the quality of seed is noted, much weedy and worthless seed is still in the markets of the country.

A new form of seed-sampling apparatus, F. TODARO (*Staz. Sper. Agr. Ital., 33 (1900), No. 5, pp. 492-494, fig. 1*).—A description is given of the form of apparatus devised by the author for sampling clover and similar seeds.

Troublesome weeds, T. W. KIRK (*New Zealand Dept. Agr. Rpt. 1900, pp. 308-312, figs. 3*).—Illustrated notes are given on cape weed (*Cryptostemma calendulacea*), cocklebur or Bathurst bur (*Xanthium spinosum*), and Strathmore weed (*Pimelea* spp.). The latter are reported as poisonous to horses.

Combating weeds by means of chemical agents, J. GRAFTIAU (*L'Ing. Agr. Gembloux, 10 (1900), No. 6, pp. 413-428*).—A review is given of experiments which have been conducted for the destruction of weeds and mosses by means of various chemical solutions. The conclusions drawn by the author are that it is possible to destroy many noxious weeds by spraying with solutions of copper sulphate or of iron sulphate. It is stated that dodder can be successfully combated by spraying with a 3 to 5 per cent solution of copper sulphate.

DISEASES OF PLANTS.

Specimens received for examination by the bacteriological laboratory, F. T. BIOLETTI (*California Sta. Rpt. 1898, pp. 183, 184, fig. 1*).—Miscellaneous notes are given on many specimens and samples which were sent to the bacteriological laboratory for examination. Among some of the more important facts brought out by the examination was the occurrence of leaf spot on violet leaves due to *Cercospora violæ* and *Phyllosticta violæ*. For the prevention of these diseases spraying plants with weak Bordeaux mixture at intervals of ten days is recommended. Specimens of diseased grapevines were sent to the author, in which the main roots were dead and a few small lateral ones remained living. The trunk and branches showed no evidence of disease except in the short growth of the previous year. The roots were covered with a fungus beneath the bark which the author considers the mycelium of some toadstool fungus. The same disease is known to occur in oak trees, and no cure is known when the plant is once thoroughly invaded by it. Preventive measures, such as digging up and burning the diseased parts, are recommended. Brief notes are given on a number of other diseases which are of minor importance.

Concentric spore spots, B. D. HALSTED (*Science, n. ser., 12 (1900), No. 303, pp. 580, 581*).—The author describes the method by which the parasitic fungi reach the surface of their host plants for the distribution of their aërial spores. The most of them have two forms, one in which the exit is made through stomata, the second type embracing those fungi which underlie the epidermis, rupturing it. To the first type belong the Peronosporas, Cercosporas, Ramularias, and Macrosporiums; while to the second type belong the Cystopus, Glœosporium, and many of the rusts. Those fungi that produce their spores through the stomata have their distribution definitely limited. The second type of spore production results in a rupture of the epidermis, and immedi-

ately surrounding this a second line of spore formation is developed in almost a circular form.

The asparagus rust in Iowa, L. H. PAMMEL and E. R. HODSON (*Iowa Sta. Bul. 53, pp. 60–67, figs. 4*).—The authors' attention was called to the appearance of the asparagus rust during the past summer, and early in September the disease was found in considerable quantity in asparagus beds on the college farm. Since that time it has been observed and reported from a number of other stations. The disease is described at some length, and its cause, *Puccinia asparagi*, is figured and described. Two parasites of this rust, *Darluca filum* and *Tubercularia persicina*, are mentioned and briefly discussed. Suggestions are given for preventive measures to be adopted, which consist principally in the propagation of resistant varieties. A short bibliography of the subject completes the bulletin.

Field experiments with tomato rot, F. S. EARLE (*Science, n. ser., 12 (1900), No. 303, pp. 579, 580*).—A description has previously been given (E. S. R., 12, p. 569) of the bacterial rot of tomatoes caused by an undescribed species of Bacillus. In the present paper an account is given of the experiments conducted for the prevention of the disease. In the previous publication the author stated as his belief that the distribution of the disease was largely effected through the presence of thrips, and the experiments here reported were conducted with a view of destroying those insects. Nine plats, with approximately 100 plants each, were the subject of the experiments. Sprayings were made on six of the plats at intervals of 3 to 5 days with kerosene, whale-oil soap, and "Rose Leaf" tobacco extract, eight applications in all being given to the plants. All of the fruits were gathered and the presence of disease noted. The rotted fruits varied from 12 to 27 per cent on different plats, the highest amount of disease occurring in one of the check plats, as well as the lowest percentage. The figures given were slightly in favor of the tobacco extract treatment. This treatment gave 5 per cent less of diseased fruits than the average of all plats; but as there was a range of 15 per cent between the highest and lowest of the check plats, the author considers the experiments inconclusive. There was an almost total absence of thrips in a fair season, and on this account some other means will have to be discovered for the spread of the disease.

The brown rot of peaches, plums, and other fruits, A. L. QUAINTANCE (*Georgia Sta. Bul. 50, pp. 237–269, figs. 9*).—The brown rot of peaches and plums has been the cause of serious loss to commercial growing of these fruits in Georgia, and the author has been led to make an extended investigation as to its cause and means for prevention. The cause of this well-known disease is the fungus *Monilia fructigena*, which is distributed widely over the United States and Europe. In the United States it is particularly disastrous to stone

fruits, the pomaceous fruits suffering but slight loss. In Europe the fungus is said to occur on plums, cherries, apricots, peaches, apples, and pears. While usually occurring upon the fruit, it also affects the flowers and twigs. The life history of the fungus is described at considerable length, and the author states that while there is some evidence that the summer spores survive the winter, yet the principal source of infection in the spring is the shriveled dried fruit commonly known as "mummies," which occur on the trees and upon the ground under them.

Results of spraying experiments for the prevention of this disease are outlined, in which cooperative experiments on large numbers of trees and experiments conducted at the station are described. The best fungicides for use in spraying proved to be Bordeaux mixture, composed of 3 lbs. of copper sulphate, 6 lbs. of lime, and 50 gal. of water. Directions are given for the proper preparation and application of the fungicide. Three applications of Bordeaux mixture, the first given just before blossoming, and a fourth spraying of copper acetate solution given when the fruit begins to color, has proved the most advantageous treatment in the author's experience. By this treatment the disease was almost entirely controlled, at a cost of chemicals and labor not to exceed 6 cts. per tree for four applications.

The leaf-spot disease of cherry trees, Müller-Thurgau (*Jahresber. Vers. Stat. u. Schule, Wädensweil, 1897–98, pp. 103–107.*—The common occurrence of a fungus, *Clasterosporium amygdalearum*, upon the leaves of a cherry was noted. In addition to occurring on the leaf, it is also found on the fruit and stems, and has a wide distribution throughout parts of Europe. For combating this disease, the choice of resistant varieties and individuals is recommended, as well as the increased virility of plants by stimulating them with fertilizers. Cutting out of badly diseased parts of trees and the working over of the soil and destruction of refuse under the trees, are suggested. Spraying beneath the trees and on the twigs before blossoming with ½ to 1 per cent solutions of Bordeaux mixture is also suggested.

The author reports the occurrence of the mycelium of *Monilia fructigena* in the twigs of apples.

Spot disease of the violet, P. H. Dorsett (*U. S. Dept. Agr., Division of Vegetable Physiology and Pathology Bul. 23, pp. 16, pls. 7*).—The author describes a spot disease of the violet, which has proved to be of serious effect in a number of houses, where violet cultivation has practically been abandoned on this account. The disease is due to *Alternaria violæ*. It attacks the plants at any stage of their growth, from a small unrooted cutting to a mature plant; and those plants making the most vigorous and rapid growth are most subject to the disease. Any part of the plant above the soil is subject to attack, and the first appearance of the disease upon the leaves may be recognized

by small, definite, circular, greenish or yellowish-white spots, varying in size from mere specks to spots $\frac{1}{32}$ in. or more in diameter. Frequently a number of such areas occur upon the same leaf, and the disease spreads until the entire leaf is destroyed. Various previous theories as to the cause and treatment of the disease are discussed, and the parasitic nature of it is shown by the author's investigations, in which artificial inoculations have been successfully made. The fungus, which is a new species, is technically described, and the varying susceptibility of different varieties is noted. Preventive measures are suggested which contemplate the keeping of plants in a healthy condition, propagating from only healthy, vigorous stock, as the best possible means. The experiments conducted with fungicides seem to show that they possess little value in preventing this disease, while rendering the foliage worthless for bunching with the flowers. The most practical means for preventing the disease appears to be in the development of strong plants which are resistant to the attacks of the fungus.

An anthracnose and a stem rot of Antirrhinum majus, F. C. STEWART (*Science, n. ser., 12 (1900), No. 303, p. 581*).—A brief account is given of two diseases of snapdragons—one an anthracnose caused by a Colletotrichum, and a stem rot due to an undetermined species of Phoma. The Colletotrichum produces elliptical depressed spots on the stems and circular dead brown spots on the leaves, and is very destructive to plants in both greenhouse and field, and at all seasons. It was found due to a new species of fungus, to which the name *C. antirrhini* was given. This disease may be successfully combated by spraying the plants once a week with Bordeaux mixture. The stem-rot disease attacks the stem, causing sections an inch or more in length to turn brown or black. This attack may occur at any point above the ground, and is usually observed a few inches below the tops of succulent shoots. Inoculation experiments show that the fungus is an active parasite of succulent shoots, but attacks woody stems with difficulty.

Experiments in the preparation of Bordeaux mixture, W. KELHOFER (*Jahresber. Vers. Stat. u. Schule, Wädensweil, 1897–98, pp. 57–68*).—Experiments were conducted to ascertain the effect of a number of factors upon the composition of Bordeaux mixture, as shown by the separation of the different mixtures upon standing. Among the experiments were those to determine the effect of iron sulphate, which is commonly present in commercial copper sulphate; upon different quantities of copper sulphate; different quantities and qualities of lime; different concentrations of mixtures; order of combining the solutions; and temperature of solutions. The presence of iron sulphate was found to cause a more rapid separation of the liquid. Within the limits of the experiments, separation was inversely

proportional to the amount of copper sulphate used. The quality of lime affected the mixture very appreciably, the mixture containing the best lime precipitating the slowest. The proportion of lime exerted the same effect as the amount of copper. Fresh, well-slaked lime gave a better mixture than poorly slaked, but fresh air-slaked lime was about its equal. Older air-slaked lime produced a mixture that separated very rapidly. Allowing the milk of lime to stand for two days was practically without effect upon the different mixtures, the results with milk of lime which had been exposed to the air being almost identical with freshly made. Bordeaux mixture made by pouring the lime into the copper solution was much inferior to the others. Where the copper mixture was poured into the lime and where both mixtures were poured into a third vessel, the mixture was about the same. Heat was found to cause a separation in the mixture in proportion to the increase of temperature.

Monilia diseases, P. SORAUER (*Ztschr. Pflanzenkrank., 10 (1900), Nos. 3-4, pp. 148-154; 5, pp. 274-284, figs. 2*).—In continuation of a previous article (E. S. R., 11, p. 949), the author describes the diseases caused by Monilia on cherries, prunes, hazelnuts, and upon the twigs of apple, pear, etc. Numerous inoculation experiments are reported, in which it was found possible to transfer the fungus from the apple to the hazelnut, cherry, apricot, and grape; and from a hazelnut to the apple, prune, haw, and grape. In the last case the development was meager and inoculation often failed. In the second part of the paper a description is given of the action of the fungus upon twigs of the apple, pear, etc.

Die-back disease of apricots, E. M. SAGE (*Jour. Agr. and Ind., South Australia, 4 (1900), No. 5, pp. 425-428, figs. 2*).—An account is given of a disease of apricot trees in which the limbs were slow in starting out one season and the following year began to die back a distance of 1 to 3 ft. from the end, in some cases the entire limb dying. The trees had been planted on rather poor soil, and the author attempted to restore their vitality by the use of fertilizers. It was found that liberal applications of bone superphosphate produced a decided improvement in the condition of the trees.

The olive knot, F. T. BIOLETTI (*California Sta. Rpt. 1898, p. 178, fig. 1*).—In Bulletin 120 of the station (E. S. R., 10, p. 55) an account is given of the occurrence, symptoms, and distribution of the olive knot in California. In the present publication a brief account is given of successful inoculation experiments, which proved that the disease is of a contagious nature and that it is due to a specific bacterium.

Experiments in combating some diseases of grapes, apples, and pears, K. MOHR (*Ztschr. Pflanzenkrank., 10 (1900), No. 5, pp. 270-274*).—An account is given of spraying grapes, apples, and pears for the prevention of the powdery mildew of the grape and scab of apples and pears. A compound of Bordeaux mixture and sulphur, and a solution of basic calcium sulphid, were used. For the grape mildew the author stated that Bordeaux mixture alone is of little value, the sulphur compounds being much preferable. The results of his experiments showed the value of the mixtures in which sulphur entered in different forms.

The influence of winter on the fungus diseases of grapes, H. SCHLEGEL (*Weinbau u. Weinhandel., 1900, No. 13, pp. 117-118*).

The grape mildew and its prevention, STEGLICH (*Sächs. Landw. Ztschr., 48 (1900), No. 18, pp. 193-195*).

Concerning the fungus which causes the black rot of grapes, A. VON JACZWESKI (*Ztschr. Pflanzenkrank., 10 (1900), No. 5, pp. 257-267, figs. 8*).—The author has reported the results of studies on the causes of the black rot of grapes, from which

he concludes that this disease is caused by three specific organisms. In the Caucasus region it is due to *Guignardia baccæ*, while in France it is caused by *G. bidwellii*. In Germany and Switzerland he has not been able to find either of these fungi, and thinks doubtless that the disease is due to a third species. An interesting point brought out in the investigation is that the general characteristics of the fungi are alike, and in practice the same treatment applies to all.

On the occurrence of Peronospora on flowers and young fruit of grapes, MÜLLER-THURGAU (*Jahresber. Vers. Stat. u. Schule, Wädensweil, 1897–98, pp. 101–103*).—The author reports having observed the presence of Peronospora upon the flowers and newly formed fruits of grapes. These appeared before the usual time for the first spraying, and the author believes that means should be taken for the destruction of the Peronospora, so that the winter spores may not be carried over to infect the plants in the spring.

Combating Oidium and Peronospora, KULISCH (*Landw. Ztschr. Elsass-Lothringen, 1900, Nos. 21, pp. 294, 295; 22, pp. 307, 308*).

Combating Oidium, J. BEHRENS (*Wchnbl. Landw. Ver. Baden, 1900, No. 11, pp. 144, 145*).

Investigations on the forms of sulphur used in viticulture, C. DUSSERRE (*Ann. Agr. Suisse, 1 (1900), No. 9, pp. 327, 330*).—An account is given of investigations of different forms of sulphur used for the prevention of grape oidium. The usual forms are sublime and triturated. A third form which recently appeared on the market is known as aerated sulphur. The physical condition of these different kinds was investigated at considerable length and is reported upon.

Recent investigations on diseases of tropical economic plants (*Ztschr. Pflanzenkrank., 10 (1900), No. 5, pp. 288–292*).—Brief notes are given, in which a number of diseases and insects of economic plants of the tropics are described, together with means that have been adopted for their destruction. The host plants mentioned are coffee, tea, cacao, sugar cane, sorghum, vanilla, St. John's bread, cocoanut palm, caoutchouc, ramie, and grapes.

The parasitism of Ximenia americana, E. HECKEL (*Compt. Rend. Acad. Sci. Paris, 131 (1900), No. 19, pp. 764, 765*).—The results of some experiments on the part of the author to infect a number of trees with this parasite are given. It was found that it was parasitic only on *Ficus laurifolia*.

Concerning the parasitism of Botryosporium, V. PEGLION (*Staz. Sper. Agr. Ital., 33 (1900), No. 6, pp. 585–589*).

A fungus disease of Casuarina, A. VON JACZEWSKI (*Ztschr. Pflanzenkrank., 10 (1900), No. 3–4, pp. 146–148, fig. 1*).—A brief account is given of an attack of *Botryosporium diffusum* on the twigs of *Casuarina leptoclada*. The fungus, which is usually a saprophyte, occurs here as a parasite, and its method of growth is described.

Carnation-stem rot, F. W. CARD and G. E. ADAMS (*Rhode Island Sta. Rpt. 1900, pp. 249–251*).—Experiments begun in 1899 (E. S. R., 12, p. 763) were continued. The principal point under consideration is a comparison of the effect of chemical *v.* stable manure as a fertilizer for these plants. The statement in the previous report is reaffirmed that new, clean sand bearing no trace of disease, and the use of soil in which carnations have not previously been grown, are the most important conditions to be secured. The experiments so far do not bear out the prevalent opinion that stable manure favors the spread of disease.

ENTOMOLOGY.

Foul brood of bees, F. C. HARRISON (*Centbl. Bakt. u. Par., 2. Abt., 6 (1900), Nos. 13, pp. 421–427; 14, pp. 457–469, figs. 4; 15, pp. 481–496; 16, pp. 513–517*). The author presents a critical review of the literature of foul brood in connection with a bibliography of 80 titles.

The symptoms of foul brood are described in detail and the disease is distinguished from chilled brood. Some writers have suspected that foul brood varied in different countries, but no bacteriological work has been done to substantiate this view. The author examined diseased larvæ from France, Switzerland, Austria, Germany, Italy, England, Cuba, and 13 States in this country, with the result that *Bacillus alvei* was isolated from every case. Slight differences were noted in the cultures, but not sufficiently pronounced to constitute a well-marked variety of the species. The pathogenicity of *B. alvei* varies in different countries and is especially virulent in new countries. The author describes in detail the different morphological and biological characters of *B. alvei*, including notes on staining methods, the germination of spores, polymorphism, and variations in the growth of the bacillus upon a large variety of culture media. In experiments to determine the relation of the bacillus to free oxygen, spores obtained from a pure culture on agar were spread on cover glasses and placed in a glass chamber so that they were constantly exposed to a current of air. The chamber was exposed to the ordinary light of a room. A cover glass was taken out every 24 hours and tested to determine whether the spores would grow. The experiment was continued for the period of a month and at the end of that time the spores still germinated rapidly. When grown on bouillon *B. alvei* produced a slight amount of ammonia. A varying amount of acid is formed in all sugar bouillon cultures of the bacillus. On potatoes a yellow pigment was produced and on gelatine cultures a peculiar odor was given off. The spores on cover glasses exposed to sunlight in September germinated after 4, 6, and 7 hours' exposure.

Experiments were conducted for the purpose of determining the thermal death point of spores of this bacillus. Test tubes containing inoculated bouillon were placed in boiling water, removed at stated intervals, cooled, and incubated. Spores from a 7 months' old culture were killed by a temperature of 100° C. for 1 hour and 20 minutes. Spores from an agar culture 9 days old germinated to some extent after an exposure of 2 hours and 45 minutes to the same temperature. Experiments were also made to determine the thermal death point of *B. alvei* in honey, during which 3 methods were used: Silk threads with dried spores on them, test tubes containing honey inoculated with spores, and capillary tubes containing a suspension of spores in distilled water. The honey was of 2 kinds, clover and buckwheat, containing 0.057 per cent and 0.17 per cent of formic acid. By the first method, there was considerable growth after 2 hours' exposure at a temperature of 114° C.; by the second method, no growth took place after exposure of 2½ hours to a temperature of 115° C.; while by the third method no growth took place after an exposure to the same temperature for 2 hours and 45 minutes.

In order to determine the relation of *B. alvei* to light, cover glasses

spread with spores and dried were exposed to direct sunlight in February. The temperature during the experiment varied from −12 to −22° C. After exposure, the cover glasses were placed film side down on agar and incubated at 37° C. Abundant growth took place within 16 hours of the different lots of spores which had been exposed to sunlight for 3, 6, and 9 hours.

Cultures of *B. alvei* were found to live longer on agar than in liquid media. The author discusses the economic aspects of foul brood and the losses due to this disease in different countries. It was observed that after a prolonged cultivation of *B. alvei*, in which more than thirty transfers had been made, the virulence of the germ seemed to be considerably decreased. The author believes that the chief method of carrying the disease from one hive to another is by bees from healthy hives robbing colonies that have become diseased. A weak and badly nourished condition of a colony of bees is considered a predisposing cause to infection by foul brood.

Remedies against foul brood are classified into three groups: The stamping-out system, starvation methods, and treatment by chemicals. In the stamping-out system, affected bees, combs, and frames must be destroyed and the hives thoroughly disinfected. By the starvation method, combs are removed and the bees allowed to fast for 2 days or more, after which they are introduced to clean new combs and fed on sirup prepared from hot water mixed with honey, nutmeg, and saffron. Since this original starvation method was proposed, various modifications of the method have been elaborated and applied in the United States and Europe. In the use of chemicals for the treatment of foul brood, the object is to secure a substance which will destroy or prevent the growth of *B. alvei* in the bees without injuring the latter. In this way the following substances have been used: Carbolic acid 1:600 of sirup; or a deciliter of carbolic acid in sirup and a liter of water thoroughly shaken together; salicylic acid, salicylic-acid vapor, camphor, thyme, thymol, carbolic acid and tar, creolin, eucalyptus, naphthol β, naphthaline, and formic acid. In experiments with these substances the various chemicals have been used both as external antiseptics and in the food of bees. Formic acid probably helps the bees to ward off an attack of foul brood. This substance is a natural constituent of honey, and it was found that the spores of the *B. alvei* develop less vigorously after cultivation on agar containing formic acid.

The author conducted experiments on the use of drugs for preventing the disease. Two small hives containing strong healthy swarms were selected for this purpose and placed side by side. Hive A was given spores of *B. alvei* in sirup containing $\frac{1}{3}$ gm. of naphthol β to a liter, while hive B was fed spores in sirup containing from 1.6 to 1.8 cc. of formic acid to the liter. The spores were poured into the

medicated sirups and the mixtures thoroughly stirred. They were readily accepted by the bees. The bees were fed 4 days per week for 3 weeks and at the end of the period none of the ordinary symptoms of foul brood had appeared. The medicated sirup was discontinued for a week and then ordinary sirup containing spores was fed. Typical symptoms of foul brood developed within 10 days, and within 16 days the disease was well established. The author tried an experiment in feeding the filtrate from a 2 weeks' old culture of *B. alvei* in saccharose bouillon mixed in sirup, in order to determine whether any increased resistance or immunity against foul brood could be produced. After 3 weeks of this treatment, spores of the bacillus were fed to the bees, with the result that foul brood developed within 14 days. Brief notes are given on the foul brood laws in force in the United States.

The action of different rays of the solar spectrum on the development of silkworms, C. Flammarion (*Bul. Min. Agr. [France], 19 (1900), No. 5, pp. 865–868*).—The author experimented upon 720 silkworms, which were placed in 12 boxes and subjected to different colored lights. The silkworms were 6 days old when the experiment began. The results of these experiments are tabulated in detail, and the more important ones may be stated as follows: The maximum production of silk took place under plain, colorless glass; the next best production of silk was obtained under clear, violet purple glass and the smallest under a dark blue glass. A rather pronounced influence was noted in different colored rays upon the determination of the sex of silkworms. Under the colorless glass the number of females was 56 per 100, while under the blue glass it was 37 to 100. The author suggests that this may be interpreted as meaning a variation in the nutrition of the silkworms under the influence of different colored lights.

Experiments in protecting man against mosquitoes by chemical agents, C. Fermi and C. Lumbao (*Centbl. Bakt. u. Par., 1. Abt., 28 (1900), No. 6–7, pp. 186–189*).—Experiments were conducted for the purpose of discovering substances which could safely be used upon the exposed parts of the body and which would kill mosquitoes. These experiments, however, did not yield promising results and were discontinued.

A number of experiments were tried in the destruction of mosquito larvæ in ponds of water. The substances used included lanolin, lard, olive oil, castor oil, vaselin, petroleum, eucalyptus, verbena, tobacco, onions, wormwood, acetic acid, carbolic acid, salicylic acid, and extracts from animals which are resistant to mosquitoes. Besides the experiments with simple substances, a number of other experiments were tried with combinations of two or more substances. Of the nearly 400 remedies which were thus tried, the following were the only ones which gave satisfactory results: Castor oil, vaselin, allyl sulphid, and benzine aldehyde, 2½ per cent; water and eucalyptus, 2½ per cent;

vaselin, lanolin, and allyl sulphid, 1 per cent; tar water, eucalyptus, and kummel, 10 per cent.

The "silver top" condition of meadow grasses in Finland, E. REUTER (*Acta Soc. Fauna et Flora Fennica, 19 (1900), No. 1, pp. 136, pls. 2*).—This article is in the nature of a monographic account of the insect attacks which result in the blasting of the heads of grasses. The author's observations are confined chiefly to *Phleum pratense* and *Alopecurus pratensis*. An elaborate classification is given of the insect attacks which cause these conditions, the classification being based on the method of attack and upon the part of the plant attacked. The author gives a review of previous investigations on this subject in other countries, together with notes on the grasses affected and on the insects which cause the damage. Among the insects which are responsible for the silver top condition in Finland may be mentioned *Hadena secalis*, *H. strigilis*, *Tortrix paleana*, *Pediculoides graminum*, *Aptinothrips rufa*, and *Tarsonemus culmicolus*. The last-named species and *Pediculoides graminum* are described as new. *P. graminum* was found to be very destructive to grasses. Pregnant females of this species were first found in the middle of July on *Phleum pratense*. From this time until fall such individuals were found in considerable numbers, especially on *Agropyrum repens*. These females attach themselves to the stems of grasses and remain so attached until their death. The author made numerous observations on the relative numbers of the two sexes of this species, and found that there appeared to be no males during the first half of the summer and that during the second half of the summer they were comparatively rare. From observations made in the field and laboratory, the author believes there are two complete generations of this insect annually. Besides the species already mentioned, the author gives notes on a number of others which are of less importance in causing the silver top condition. The complete list as studied by the author includes 4 species of Thysanoptera, 5 of Lepidoptera, 6 of Diptera, 2 of Hymenoptera, 1 of Hemiptera, and 4 species of mites. An extended bibliography is given of the literature relating to this subject.

The strawberry-root louse; the destructive pea louse in Delaware, E. D. SANDERSON (*Delaware Sta. Bul. 49, pp. 24, figs. 7*).—The author gives notes on the habits and life history of *Aphis forbesi*, and describes the preventive remedies which have given best success in combating this insect. Among such remedies mention may be made of the use of uninfested plants, rotation of crops, and disinfection of strawberry plants by dipping in kerosene emulsion or tobacco water, or by fumigation with hydrocyanic-acid gas.

Notes are given on the occurrence of the destructive pea louse in Delaware. Its preferred food plant is said to be crimson clover. An experiment was tried in spring on an acre of infested peas with a

25 per cent mixture of kerosene and water. The majority of the lice were killed, but the author does not consider this method as capable of practical use on a large scale. He believes that the destructive pea louse is a well-known insect, described under the name *Nectarophora pisi*.

Supplement to my article on "American fruit and its parasites," C. BRICK (*Bot. Mus., Abt. Pflanzenschutz, Hamburg, 2 (1899–1900), pp. 19*).—In this article the author gives an account of the amount of fresh and dried American fruit received in Hamburg, and indicates the percentage of such fruit infested by various scales and fungus diseases. The San José scale was found infesting 3.12 per cent of 82,802 packages of fruit. Of the apples which came from the eastern part of the United States, 1.84 per cent were infested, while the California apples showed an infestation of 42.44 per cent and the Oregon apples 51.44 per cent. In infested packages the lowest infestation was 1 per cent, while in many cases almost every apple in the package was infested with the scale. In 23 shipments from Eastern States which were infested with the San José scale, *Aspidiotus forbesi* and the scurfy scale were also found.

As bearing upon the question of the origin of the San José scale the author reports that this insect was found upon the following species of living plants imported directly from Japan, viz: *Prunus mume*, *P. mume pendula*, *P. pendula*, *P. persica*, *P. pseudo-cerasus*, *P. cerasus*, *Citrus trifoliata*, and *Salix multinervis*. On some of these plants San José scale was found in all of its stages. Among the other insect parasites and fungus diseases which were found on the American fruit the following may be mentioned: Forbes scale, scurfy scale, oyster-shell bark-louse, *Aspidiotus ancylus*, *A. camelliæ*, *Gymnosporangium macropus*, and *Capnodium salicinum*.

The San José scale was found on 20 crates of pears from California. In shipments of dried fruit the San José scale was found infesting 3,052 crates of pears and 50 crates of nectarines. Besides other species of scales already mentioned, *Diaspis fallax* was found on apricots.

Crude petroleum v. the San José or pernicious scale, J. B. SMITH (*New Jersey Stas. Bul. 146, pp. 20*).—In this bulletin the author summarizes the general results of his experiments with crude petroleum as an insecticide against the San José scale since 1897. More than 50,000 fruit trees of different kinds have been sprayed with crude petroleum under the direction of the author or have been subsequently inspected by him. In investigating the cause of damage to trees from crude petroleum in the hands of certain experimenters, the author found that the name crude petroleum had no definite meaning and included a number of oils of very different specific gravity. The one with which the author's experiments were conducted had a specific gravity of 43 per cent and was of a dark green color. Some inter-

mediate oils were found with a specific gravity as low as 35 per cent. This last specimen was almost uniformly fatal to foliage. Further study revealed the fact that even true crude oils differ considerably in color, specific gravity, and otherwise. In studying the difference between crude oils the author found that as a rule when oil wells were shot and the surrounding trees were covered with crude oil no damage to the foliage resulted.

Details are given of a number of additional experiments with crude oil by the author and fruit raisers. The author used this substance on peach, pear, apple, plum, and cherry trees without causing any harm. One branch of a cherry tree was painted with an intermediate oil with a specific gravity of 35 per cent and another branch of the same tree with a crude oil of 43 per cent on the same day. The former branch died and the latter developed flowers normally. Near Riverton 25 bbls. of crude oil were sprayed on apple, pear, and peach trees and currant and gooseberry vines. No injury was produced on any variety. Experiments in spraying Japanese walnuts, native butternuts, and chestnut trees with crude oil resulted in serious injury to all the trees. Details are given of a number of other experiments by fruit raisers with varying results as to injury to the trees. The author discusses the subject of the action of the oil, method of applying it, the reliable firms of whom oil may be purchased, and its range of usefulness. It is stated that crude petroleum should be used as an insecticide in winter applications only. Summer treatment for San José scale may be made with tobacco extracts and fish-oil soaps. The author concludes that the San José scale can be as certainly controlled as many other injurious insects and that crude petroleum of the proper quality, rightly used, "forms a reasonably safe, economical, and effective material for the purpose." These conclusions are for Atlantic States and should not be relied upon in arid regions without further experiments.

A report on the scientific works on entomology during 1898, R. LUCAS and G. SEIDLITZ (*Arch. Naturgesch., 65 (1899), II, No. 2, 1. half, pp. 330*).—In the first part of this report a bibliographical list is given of articles on entomology published in 1898. In the second part of the report, articles dealing with Coleoptera are listed alphabetically under the authors' names, geographically according to countries and periodical publications, and also according to subjects. The references to American literature on entomology, especially to experiment station publications, are very incomplete, only a few of such bulletins being mentioned.

The century's work among the aculeate Hymenoptera, F. D. MORICE (*Ent. Rec. and Jour. Variation, 13 (1901), No. 1, pp. 12–14*).—Brief notes on the more important publications on this group of insects.

The Lepidopterological books of the nineteenth century, L. B. PROUT (*Ent. Rec. and Jour. Variation, 13 (1901), No. 1, pp. 20–25*).—This article contains a brief discussion of the literature of this subject, with bibliographical references.

The progress of our knowledge of the dragon flies during a century and a half, W. F. KIRBY (*Ent. Rec. and Jour. Variation, 13 (1901), No. 1, pp. 7–11*).—The author classifies the more important literature on this subject into a Linnean period

and a modern period, embracing general works on dragon flies, works relating to European dragon flies, to British dragon flies, and to American dragon flies.

Evolution of our knowledge of the Ichneumonidæ during the nineteenth century, C. MORLEY (*Ent. Rec. and Jour. Variation, 13 (1901), No. 1, pp. 15–18*).—The author illustrates the progress made in the knowledge of this group of insects by references to the more important literature on the subject.

A study of the structure of the ocelli of insects, W. REDIKORZEW (*Ztschr. Wiss. Zool., 68 (1900), No. 4, pp. 580–624, pls. 2, figs. 7*).—The author discusses in detail the microscopical elements of the simple eyes in insects. Material for this study was obtained from a number of species, of which mention may be made of the honeybee, syrphus flies, and species of Cimbex and Perla. A bibliography of the subject is appended to the article.

Parthenogenesis in bees, A. WEISMANN (*Anat. Anzeiger, 18 (1900), No. 20–21, pp. 492–499*).—The author discusses in a general way the factors which have been supposed by different authors to be concerned in determining the sex of different members of the bee colony.

The treatment of foul brood by eucalyptus, salicylic acid, and formic acid, J. B. GRAMONT (*Rev. Internat. Apicult., 22 (1900), No. 10, pp. 225, 226*).—From observations and experiments the author concludes that the most effective and convenient method of treating hives infected with this disease is by the use of formaldehyde.

The use of honey, J. CRÉPIEUX-JAMIN (*Rev. Internat. Apicult., 22 (1900), No. 10, pp. 206–210*).—The author reports a number of cases in which honey was eaten in considerable quantities after fatiguing exercise. The results indicated a beneficial effect from the honey.

The common European praying mantis, a new beneficial insect in America, M. V. SLINGERLAND (*New York Cornell Sta. Bul. 185, pp. 33–47, figs. 14*).—This insect has recently been discovered in the neighborhood of Rochester, N. Y., and it is believed that the species was introduced into this country by a nurseryman. Brief notes are given on its habits and life history.

Report of the entomologist, L. BRUNER (*Nebraska State Bd. Agr. Rpt. 1899, pp. 103–142, pls. 16*).—In this report the author discusses in a popular manner the insects which are injurious to native grasses on prairies and in meadows. Especial attention is given to the leaf hoppers, and a brief bibliography is presented on the insects which affect grasses. W. D. Hunter presents an additional list of insects injurious to clover and alfalfa.

Report of the zoologist, H. B. WARD (*Nebraska State Bd. Agr. Rpt. 1899, pp. 193–205, figs. 6*).—This report contains an account of the ticks of Nebraska. An analytical table for the determination of species is given, and notes are presented on the life history and habits of *Argas americanus*, *Ornithodoros megnini*, *Dermacentor americanus*, *Boophilus bovis*, *Ixodes reduvius*, and *Amblyomma americanum*.

Report on the work of the State entomologist for the year 1899, S. LAMPA (*Ent. Tidskr., 21 (1900), No. 2, pp. 49–96*).—The author gives a detailed account of the office of the State entomologist. It is stated that *Pyrethrum roseum* has been grown successfully on the grounds near the office, with the result that a sufficient quantity of pyrethrum powder has been manufactured for a year's supply. The Hessian fly and *Chlorops pumilionis* are reported as causing considerable damage in the region of Gotland. Great destruction was wrought by *Lymantria monacha*. An assistant conducted a number of spraying experiments with a 2 to 4 per cent solution of lysol in water and with a kerosene emulsion. The buds of fruit trees were not injured by a 1 per cent solution of lysol.

Brief notes are given on the habits and life history of *Hadena basilinea*, *Tipula oleracea*, *Agriotes lineatus*, *A. segetum*, cabbage-root maggot, *Psila rosæ*, *Charæas graminis*, *Argyresthia conjugella*, codling moth, and numerous other injurious insects.

Observations on insects, T. D. A. Cockerell (*New Mexico Sta. Bul. 35, pp. 27, figs. 10*). This bulletin contains brief popular notes on a number of economic insects, among which mention may be made of *Scolopendra heros, Bryobia pratensis, Apis dorsata*, pear slug, striped cucumber beetle, *Epitrix cucumeris, Epilachna varivestis*, harlequin cabbage bug, squash bug, false chinch bug, and woolly aphis.

Experimental entomology, F. Merrifield (*Ent. Rec. and Jour. Variation, 13 (1901), No. 1, pp. 26-31*).—The author calls attention to the necessity for more careful observations under experimental conditions on the habits and life history of economic and other insects.

Insects injurious to cereals, V. Mayet (*Prog. Agr. et Vit. (Éd. L'Est), 21 (1900), No. 49, pp. 691-698, pl. 1*).—The author discusses the life history and habits of *Crioceris melanopa, Hippopsis gracilis, Tenebrio molitor*, and *Agriotes lineatus*. Brief notes are given on the remedial measures which have been most effective in combating the attacks of these insects.

The life habits of certain grasshoppers, R. Tümpel (*Allg. Ztschr. Ent., 6 (1901), No. 1, pp. 3-7*).—The author relates his observations on the habits and life history of *Locusta viridissima, Decticus verrucivorus*, and *Meconema varium*.

On locust destruction (*Agr. Jour. Cape Good Hope, 17 (1900), No. 9, pp. 535-540, figs. 2*).—The following methods for destroying locusts are recommended: The use of canvas screens with a strip of oilcloth 4½ in. wide sewn on the top of the canvas so as to direct the locusts into pits, where they are destroyed; trampling by herds of sheep or goats; dragging with bushes; beating with flails; and the use of the locust fungus. Mention is made of an insect enemy of the locust known as *Cynomia pictifacies*.

Locust destruction (*Agr. Jour. Cape Good Hope, 17 (1900), No. 10, pp. 619, 620, fig. 1*).—An account of brief reports by C. W. Sparkes and Mr. Halse concerning the distribution of locust fungus and the use of a bush harrow in destroying the young locusts.

The apple maggot, F. W. Card and G. E. Adams (*Rhode Island Sta. Rpt. 1900, pp. 247, 248*).—Observations were made upon the effect of plowing underneath trees on the prevalence of this insect. At first results were obtained which seemed to be very promising, but on September 19, 1899, 500 apples from the trees which were under treatment and an equal number from a neighboring tree the ground under which had not been plowed were examined, with the result that 236 apples of the first lot and 394 of the second lot were found affected. The infestation in the first lot of apples was, however, not so serious as in the second lot, and the authors believe that the method offers some encouragement.

The grape-root worm, a new grape pest in New York, M. V. Slingerland (*New York Cornell Sta. Bul. 184, pp. 17-32, figs. 10*).—A report of an insect injurious to grapes at Ripley, in the Chautauqua Lake grape region, was sent to the author in September. An examination of the vineyard showed that it was set in fertile soil and had had good care. The leaves on affected vines showed the effects of the insects' attack in the form of small holes. A number of larvæ were found at work on the roots of such grapevines, and it is believed by the author that the species is *Fidia viticida*, although no specimens were reared to maturity. Brief popular notes are given on the life history and habits of this insect.

Tortrix ambiguella and T. pilleriana, J. Jablonowski (*Kisérlet. Közlem., 3 (1900), No. 4, pp. 269-360, pls. 3, figs. 8*).—The author reviews a part of the literature which deals with these two species, and gives a detailed account of their anatomy, life history, habits, and food plants. Among the natural enemies of *T. ambiguella* the author mentions *Anomalon flaveolatum, Vespa vulgaris*, and a bacterial disease apparently due to the attack of a micrococcus. Among the artificial remedies which were tried against these insects, mention may be made of the kerosene lamp and pyrethrum. The synonymy of both species is discussed in considerable detail. *T. ambiguella* is said to be double-brooded in Hungary, while *T. pilleriana* has but one

brood annually. Both species are permanently established in the vicinity of vineyards and become periodically from 4 to 5 times as numerous as usual and correspondingly injurious.

The rôle of insects in the forest, J. B. SMITH (*Rpt. State Geol. New Jersey, 1899, pp. 205–232, figs. 9*).—The author gives popular accounts of a number of injurious forest insects, among which mention may be made of gall wasps, the tulip soft scale, bark beetles, ambrosia beetles, *Prionoxystus robiniæ*, and *Lyctus striatus*. The agency of birds in destroying forest insects is briefly discussed by the author, and notes are also given on the more common insecticide methods for destroying such insects.

An outbreak of Psilura monacha, E. WÖHL (*Illus. Ztschr. Ent., 5 (1900), No. 23, pp. 364–366*).—This insect is reported as having been unusually injurious for the past 5 years in the forests of Oberselesien. The area which is specially devastated by the species includes several square miles. In localities where the injuries were unusually severe, attempts were made to check the insect by collecting the eggs and larvæ and by the use of tar bands upon the trees. These methods, however, did not prove very effective.

Cyanid of potash as a remedy for phylloxera, Mytilapsis fulva, and Parlatoria ziziphi, G. FLORIANO (*Staz. Sper. Agr. Ital., 33 (1900), No. 1, pp. 5–18*).—The author tried a number of experiments in inoculating cyanid of potash into grapevines and citrus trees for the purpose of determining the extent to which it is absorbed by the juice of the plant and whether it would kill insects which were feeding upon plants at such times. When the cyanid of potash was applied at the vintage term it was absorbed quite abundantly by the grapevines and distributed both upward and downward from the point of inoculation. It was observed, however, that the phylloxera continued to develop and multiply as on vines which were not treated. When cyanid of potash was applied as a remedy against *M. fulva* and *P. ziziphi* on citrus trees no benefit was observed; the plants were somewhat damaged and the insects were not affected.

Sprays and washes, C. W. WOODWORTH (*California Sta. Rpt. 1898, pp. 181, 182*).—The author gives formulas and directions for preparing Paris green, kerosene emulsion, rosin soap, lime salt and sulphur, sulphid of potash, Bordeaux mixture, and ammonia copper carbonate.

Experiments with insecticides and fungicides, N. G. MUKERJI (*Ann. Rpt. Sibpur Expt. Farm, 1899–1900, pp. 9, 10*).—In combating the attacks of *Hispa ænescens* upon paddy, experiments were tried with a knapsack vaporizer and a number of spraying bellows. The insecticides which were used included tobacco decoction, kerosene emulsion, turmeric dust, and a powder containing ashes, lime, arsenic, soot, and asafœtida. The last-named insecticide seemed to be very effective.

The orchard and nursery inspection law (*Ohio Sta. Rpt. 1900, pp. XXVII–XXIX*).—This is a copy of a law recently passed in Ohio to prevent the introduction and spread of the San José scale, other dangerous insects, and contagious diseases affecting various trees and plants.

FOODS—ANIMAL PRODUCTION.

Report of the analyst [on the adulteration of food and drug inspection] (*Massachusetts State Bd. Health Rpt. 1899–1900, pp. 603–652*). Of the 4,435 samples of milk analyzed, 27.2 per cent were found to be adulterated, and of the 2,615 samples of foods other than milk, 14.8 per cent. In addition to other data relating to the subjects discussed, the composition of a considerable number of samples of condensed milk is reported.

In investigating the possibilities of tin from cans being dissolved in fruit juice or in the vinegar sometimes used in canning sardines, the author placed sheets of tin equivalent in size to the interior surface of a can in solutions of varying strength of malic, tartaric, citric, and acetic acids in sealed pint glass jars. The solutions were examined at the end of 3 months, 6 months, and 1 year. One pint of the one-fifteenth normal malic-acid solution in 3 months dissolved 0.0197 gm. tin; the same strength tartaric acid, 0.0246 gm.; and citric acid, 0.0236 gm. It was found in general that the maximum amount of tin was dissolved at the expiration of 3 months. A fifth normal malic-acid solution dissolved 0.0578 gm. tin; a tenth normal solution, 0.0201 gm.; a tenth normal solution of tartaric acid, 0.0382 gm.; of citric acid, 0.0374 gm.; of acetic acid, 0.0019 gm. In 6 months the tenth normal acetic acid had dissolved 0.0083 gm. metallic tin. A method for determining tin in canned goods is described.

Studies on beans, T. KOSUTÁNY (*Landw. Vers. Stat.*, *54* (*1900*), *No. 5–6*, *pp. 463–479*, *pl. 1*).—The author reports the composition of a number of sorts of beans of French origin and of the same varieties grown in Hungary, together with the weight of the beans, a chemical study of bean oil or fat, and the results of tests of the time required for cooking in distilled water, tap water (river water), and well water, and water to which sodium carbonate or magnesia had been added. As shown by the amount of water absorbed, beans cooked better in distilled water than in tap water or well water. Although the softening of the beans by cooking is influenced by the lime and magnesium content of the water, it is not directly proportional to the lime content. Fresh beans did not cook as readily as older ones. The beans cooked more readily when soda was added to the water, and less readily when magnesia was added.

Remarks on the use of borax and formaldehyde as preservatives of food, W. D. HALLIBURTON (*British Med. Jour.*, *1900*, *No. 2062*, *pp. 1*, *2*; *abs. in British Food Jour.*, *2* (*1900*), *No. 21*, *p. 244*).—In experiments by methods of artificial digestion the author found that 1 part of borax in 1,000 parts of milk completely prevented the curdling action of rennet and even smaller amounts of borax delayed this action. Formaldehyde hindered very markedly the digestibility of fibrin and starch. It appears that soaking two or three days in a 0.5 per cent solution of formaldehyde rendered the artificial gastric digestion of fibrin almost impossible and that even soaking in 0.05 per cent of formaldehyde hindered it very much. Fresh fibrin was digested in 30 minutes by a pepsin solution. When soaked 2 days in a 0.05 per cent formaldehyde solution it was digested in 96 minutes and when soaked in a 0.1 per cent solution or over, it was not digested at all in 24 hours. Formaldehyde, even in small amounts, hindered the pancreatic digestion of starch. The addition of 2 drops of forma-

lin (a 40 per cent solution of formaldehyde) to a fluid ounce of milk greatly delayed the curdling action of rennet. Smaller amounts hindered it less, but in every case the curd formed was less firm than normal.

The relation between temperature and fermentation in the ensiling of green fodders, A. VAUCHEZ, P. MARCHAL, ET AL. (*Ann. Sci. Agron., 1900, II, No. 1, pp. 1-32, figs. 5, charts 9*).—A record is given of observations on the variations in temperature and in the products of fermentation in silage prepared in different ways. The process of ensiling is defined as the conservation of green fodders by the antiseptic products of their fermentation. The nature, intensity, and duration of the fermentation depend upon the amount of oxygen which gains access to the ensiled material. The main object sought is to prevent as completely as possible the access of oxygen. The three main factors influencing the supply of oxygen in the silo are (1) the character and form of the silo, (2) the method of filling, and (3) the weighting and packing of the silage. The pit silo is recommended because it can be made more nearly air-tight than the above-ground silo. The form of the silo should be as nearly as possible cubical, with rounded corners. In order that the silage may settle uniformly it is recommended that the bottom be made slightly smaller than the top, the incline of the sides being about 5 to 10 cm. per meter. Rapid filling of the silo is not considered advisable, since it is believed that silage of the best quality is obtained by allowing all portions of the mass to undergo the same degree of fermentation. When this condition has been reached the material may be weighted, preferably with soil. Plants in the flowering stage are considered to be in the best condition for ensiling, since more mature, drier plants do not undergo satisfactory fermentation, although this defect may be corrected to some extent by wetting the material as the silo is filled. The method of filling, wetting, and weighting should be varied with the temperature and character of fermentation going on in the silo. A certain degree of fermentation is necessary to the production of the best product. Too great fermentation destroys its value. The best silage is as a rule obtained with temperatures between 55 and 70°. With a temperature over 84° the silage is black and of poor quality.

Excretion of urea by the skin in health, C. C. EASTERBOOK (*Scottish Med. and Surg. Jour., 6 (1900), No. 2, pp. 120-140*).—Experiments which have to do with the question of the effect of muscular work on the excretion of nitrogen were made, the author himself being the subject. The effect of muscular work and hot baths on the excretion of urea by the skin was studied. Both the work and the baths would each induce profuse perspiration. The composition of the foods making up the uniform diet eaten was calculated and the urine analyzed. The urea in samples of perspiration was also determined.

The author's principal conclusions on the effect of muscular work on the excretion of urea follow:

"When free perspiration was induced the percentage of urea in the sweat rose and remained high as long as the perspiration continued. This was most marked when perspiration was induced by those forms of exercise which involved the free use of the bulk of the muscles of the body, *e. g.*, bicycling and dancing and running. In my opinion this rise in the urea of the sweat of exercise is the direct proof of an increase in proteid metabolism during exercise. . . . During active exercise on a fixed diet the urinary urea gives variable readings according apparently to the degree of concomitant perspiration. The cutaneous urea is always increased; the urinary urea may also be increased, it is more often unaffected, and sometimes it is decreased, but only when sweating has been profuse, and so has carried off an extra amount of urea from the body. For a day or two after active exercise the urinary urea may rise. This rise may be due to a continuance of the excretion of the additional urea in the system, and to a persistence for a longer or shorter time of the stimulating effect of exercise upon the bioplasm of the body. . . .

"The reason why the skin excretes more urea than usual during exercise is probably because it and the lungs are for the time being the naturally predominating organs of elimination. The most obvious accompaniments of muscular exercise are an increased respiration and perspiration. During the perspiration of exercise the skin discharges (1) more water, which by its evaporation serves to carry off most of the additional heat which is being liberated within the body as the result of the increased oxidations; (2) more carbonic acid, and (3) more urea, which is determined toward those organs of excretion which are predominantly active at the time, and so is discharged in relatively larger quantity by the sweat glands, and in relatively less amount by the kidneys."

Milk and artificial foods for fattening calves, D. DICKSON and L. MALPEAUX (*Ann. Agron., 26 (1900), No. 5, pp. 217–245, figs. 4*).—Experiments are reported on the comparative value for fattening calves of whole milk; skim milk and potato starch; skim milk, starch, and a decoction of flaxseed; skim milk and rice flour; skim milk, rice flour, and a decoction of flaxseed; whole milk with water and barley meal or flour added; skim milk and malt flour; skim milk and artificial cream (an emulsion of peanut oil, sugar and some other substance); skim milk and oleomargarine; and, hay tea and flour. Among the conclusions reached were the following: As regards the quantity of flesh produced and the quality of the meat, the best results were always obtained in fattening calves with pure rich milk. Of the different substances used in combination with skim milk, the best results were obtained with the malt preparations. A decoction of flaxseed with flour or rice starch gave meat of a superior quality. Malt flour cooked with skim milk constituted an economical food and gave very good results. Oleomargarine and sugar may be used with skim milk in the same way as starch and rice flour. Rationally employed it gave very good results, but the quality of the meat produced was not of the best.

Feeding trials with work horses, J. H. SHEPPERD (*North Dakota Sta. Bul. 45, pp. 577–587*).—Timothy hay and brome grass supplemented by oats were compared with horses performing the same

amount of work. It was found that in 42 days there was an average daily gain in weight of 0.42 lb. on the first ration and 0.77 lb. on the second. In studying the comparative value of barley and oats, the former grain was fed for 9 months to 3 horses and 2 mules, timothy hay being supplied in addition to the grain. The mules did not eat the barley with marked relish at any time although during the first 2 months, while at light work, they consumed a sufficient amount to keep them in good condition. When the work was increased, they could not be induced to eat a correspondingly increased amount of barley and frequently refused it altogether. An oat ration was then given them on alternate months. The oats were eaten with apparent relish and on this food gains in weight were made. Two work horses were fed alternately oats and barley, supplemented by timothy hay in 28 day periods for 252 days. On an average there was a daily gain of 0.38 lb. on oats and a loss of 0.15 lb. on barley. When malted barley was compared with oats (the grains being supplemented by oat hay) in a test with 4 work horses, there was an average daily gain in a 49 day period of 0.49 lb. on oats, while on malted barley there was a loss of 0.76 lb. A mixture of malt and bran, 2 : 1, was then compared with oats with the same horses. The test covered two periods of 4 weeks each. Oat hay was supplied for coarse fodder. On the oat ration there was an average daily gain of 0.22 lb. and on the malted barley and bran ration a loss of 0.80 lb. In this and other tests the amount of work done by the different horses was the same. Corn and oats were compared with 2 mules for 84 days, one receiving a ration of oats and corn, the other, of oats alone. Ear corn was used and little or none of the cobs was eaten. The rations were so alternated that the author believes the effects of individuality were counterbalanced. On the corn and oats there was an average daily gain per mule of 0.70 lb. and on the oats a loss of 0.60 lb. Tests from a previous bulletin are reprinted for purposes of comparison (E. S. R., 7, p. 801).

The author's principal conclusions follow:

"Brome hay gave as good results when fed to work horses as did timothy hay. Barley was not equal to oats in feeding value per pound, but was nearly as good. Mules did not relish barley. Malted barley was not so valuable for work horses as oats and was not equal in value to the dry barley from which it came. Corn fed in connection with oats in the proportion of 100 lbs. of corn to 125 lbs. of oats, had greater value than oats; 77.5 lbs. of corn equaled 100 lbs. of oats when fed to work horses."

Cereal breakfast foods, A. P. BRYANT (*Dietet. and Hyg. Gaz., 16 (1900), No. 8, pp. 451–453*).—A discussion of the food value of different classes of cereal breakfast foods as compared with other common food stuffs.

The Schweitzer system of bread making in Paris, W. P. ATWELL (*U. S. Consular Rpts., 62 (1900), No. 234, pp. 307–309*).—A special process of cleaning wheat, of grinding it, and of bread making is described. A peculiarity of this process is that the grain is ground only as needed. The cleaned wheat "passes into the mill com-

posed of flat, circular steel grinders, grooved in such a manner that they accomplish the decortication of the kernel and its granulation into meal at the same time. These grinders are movable but do not touch, so that instead of crushing the wheat and producing a flour in which the starch only is retained, the outer and harder portion of the wheat, containing gluten and other nutritive properties, is retained in the flour. The bran alone is expelled." The bread is made almost entirely by machinery.

Banana flour (*Dietet. and Hyg. Gaz., 16 (1900), No. 8, p. 466*).—A brief note on the value of banana flour.

On an apocynaceous plant yielding large edible tubers, R. T. BAKER (*Proc. Linn. Soc. New South Wales, 24 (1899), pt. 3, No. 95, pp. 385–389, pls. 2, fig. 1*).—A description is given of *Parsonia paddisoni*, a glabrous woody climber, producing edible tubers, and an analysis of the tubers reported. These are known in Australia as "native yams" and are eaten by both colonists and aboriginals. In taste, both raw and cooked, they are said to resemble turnips.

The nutritive value of desiccated vegetables, M. E. JAFFA (*California Sta. Rpt. 1898, pp. 154–157*).—The composition of samples of different sorts of evaporated potatoes and a sample of evaporated carrots, is reported. The author discusses the food value of this class of goods, and compares the California evaporated potatoes with the products of Eastern manufacture.

Examination of canned fruits, G. E. COLBY (*California Sta. Rpt. 1898, pp. 157–159*).—The amount of cane fruit and grape sugar in samples of canned apricots is reported.

Investigations of canned products, E. W. HILGARD and G. E. COLBY (*California Sta. Rpt. 1898, pp. 159–164, dgm. 1*).—An examination of spoiled canned asparagus showed that those cans which were not what is technically known as "swells" owed their high acidity to the fluid used in soldering the cans. Zinc and lead were also found, the former being present in the fluid used in soldering and the latter dissolved by the acid present. Experiments were made on the influence of heating upon the liquor of canned asparagus, containing various amounts of soldering fluid. On prolonged heating the acidity of the canned contents increased materially. "This is doubtless to be accounted for by the transformation of the characteristic crystallizable ingredient of asparagus, asparagin, into aspartic acid, by the action of the zinc chlorid [of the soldering fluid]." Analyses show that a not inconsiderable amount of tin accompanied the zinc and usually traces of lead salts. Tests are also reported on the comparative effect of dilute hydrochloric acid upon sheet tin of two kinds. The authors recommend improvements in methods of soldering cans and point out the need of sufficient sterilization.

Poisonous effects of eating meat, P. B. RASMUSSEN (*Maanedsskr. Dyrlæger, 12 (1900), No. 9, pp. 329–364*).—This article contains a report on investigations of a large number of cases of poisoning which occurred in consequence of eating fresh meat or meat in the form of sausage and other preparations. The author discusses the pathological changes in the meat of animals affected with various diseases, and the dangers of using such meat for food. Among the diseases thus considered may be mentioned various fever conditions, septicaemia, and osteomyelitis. Brief notes are given on the bacteria which were found associated with poisonous meats.

The relation of ethyl alcohol to the nutrition of the animal body, W. S. HALL (*Dietet. and Hyg. Gaz., 16 (1900), No. 8, pp. 453–461*).—This abstract of a paper presented at the fifty-first annual meeting of the American Medical Association, held at Atlantic City, N. J., June, 1900, is reprinted from the *Journal of the American Medical Association.* A controversial article.

Influence of alcohol on the lacteal secretion (*Dietet. and Hyg. Gaz., 16 (1900), No. 7, pp. 405, 406*).—A summary of some recent work.

Respiration experiments with a corpulent subject, A. SCHATTENFROH (*Arch. Hyg., 38 (1900), No. 2, pp. 93–113, figs. 2*).—The respiratory quotient was determined under a number of conditions of work and rest.

Man's power of accommodation to high and low temperatures, M. RUBNER (*Arch. Hyg., 38 (1900), No. 2, pp. 120–147*).—A study of the effect of climate on man. The respiratory quotient was determined, and in some cases the excretion of nitrogen in the urine. The effect of alcohol on carbon dioxid and water excretion at high and low temperatures was also studied.

Comparative experiments on the activity of the skin of Europeans and negroes, together with observations on diet in warm climates, M. RUBNER (*Arch. Hyg., 38 (1900), No. 2, pp. 148–159*).—Respiration experiments, in which the production of carbon dioxid and water was measured, are reported with a negro and a European. On the basis of these experiments and theoretical considerations deductions are drawn regarding the kind and amount of food required in the Tropics.

Contribution to our knowledge of proteid metabolism in children, F. W. TUNNECLIFFE and O. ROSENHEIM (*British Med. Jour., 1900, No. 2076, pp. 1083–1088, dgms. 3*).—A comparison as part of a simple mixed diet for young children was made of milk, meat, and "plasmon," a food product prepared from the precipitated casein of milk. The balance of income and outgo of nitrogen was determined, and in one case that of phosphorus. Food, urine, and feces were analyzed. The principal conclusions follow: Plasmon can replace meat in a mixed diet for children in proportion to its nitrogen content. The phosphorus of plasmon can be assimilated and retained. Greater gains in weight were made during the plasmon period than during the meat period in the three experiments reported.

The sweet potato (Ipomæa batatas), L. BONNIN (*Rev. Cult. Coloniales, 7 (1900), No. 66, pp. 709–711*).—A note on the feeding value of the sweet potato. Chemical analyses of sweet-potato flour and other products with their nutritive ratios are given.

Investigation of California cattle foods, M. E. JAFFA (*California Sta. Rpt. 1898, pp. 131–136*).—The composition is reported of sugar-beet leaves, crowns and tops, foxtail hay (*Eriogonum parvifolium*), corn meal, wheat bran, wheat middlings, shorts, mixed feed, rolled barley, rice hulls, rice, and pine nuts, as well as the protein content of dried blood, bean meal, and macaroni flour.

Glycogen formation after inulin feeding, R. NAKASEKO (*Amer. Jour. Physiol., 4 (1900), No. 5, pp. 246–250*).—According to the author's experiments and those of other investigators which he cites, "the glycogen-forming properties of inulin, in the case of the rabbit at least, must still be regarded as uncertain or minimal."

The behavior of certain artificial hexoses, A. MÜNCH (*Ztschr. Physiol. Chem., 29 (1900), No. 6, pp. 493–516*).—Experiments with rabbits and dogs showed that formose, methose, and methyl glycosid served to induce a storage of glycogen in the liver.

The source of fat in the animal organism (*Dietet. and Hyg. Gaz., 16 (1900), No. 9, pp. 529, 530*).—The possibility of the formation from fat of protein is discussed.

Can unsaponified fat be resorbed? L. HOFBAUER (*Arch. Physiol. [Pflüger], 81 (1900), No. 4–5, pp. 263–266*).—Experiments with dogs fed fat, artificially colored, led the author to conclude that unsaponified fat can be resorbed in the intestine.

On the resorption of artificially colored fat, E. PFLÜGER (*Arch. Physiol. [Pflüger], 81 (1900), No. 8–9, pp. 375–380*).—A controversial article. The author believes that Hofbauer's deductions are not warranted by the experimental evidence.

The influence of food and fasting upon animal heat (*Dietet. and Hyg. Gaz., 16 (1900), No. 8, pp. 463, 464*).—A general discussion of the subject with a citation of some of Mosso's experiments.

Concerning some quantitative relations in digestion by pepsin, E. SCHÜTZ and HUPPERT (*Arch. Physiol.* [*Pflüger*], *80* (*1900*), *No. 8–10, pp. 470–526*).—An experimental study of the physiology of digestion, with special reference to quantitative results.

Feeding rice meal to pigs, C. M. CONNER (*South Carolina Sta. Bul. 55, pp. 7*).—Corn meal and rice meal were compared with two lots of 3 Berkshire pigs each, the grain ration being supplemented by skim milk. The pigs weighed about 90 lbs. each at the beginning of the test, which covered two periods of 29 and 32 days, respectively. The rations were reversed in the second period. Considering the results of the whole test, the average daily gain per pig on the ration containing rice meal was 1.72 lbs.; on corn meal, 1.66 lbs.; the cost of a pound of gain in the two cases being, respectively, 3.84 cts. and 4.63 cts. A pound of gain required 2.48 lbs. rice meal and 9.91 lbs. skim milk as compared with 2.57 lbs. of corn meal and 10.28 lbs. milk. According to the author rice meal when fed with skim milk has a value equal to corn meal.

Special instruction in poultry culture, A. A. BRIGHAM (*Rhode Island Sta. Bul. 72, pp. 21–36, pls. 9*).—The special course of instruction on the care and management of poultry which the station offers is described.

Heredity, A. A. BRIGHAM (*Rhode Island Sta. Rpt. 1900, pp. 337–346*).—A popular discussion with special reference to poultry.

DAIRY FARMING—DAIRYING.

Feeding experiments, H. J. WING (*Georgia Sta. Bul. 49, pp. 207–227*).—The station has conducted experiments for several years to ascertain the cost of milk and butter production. The average production of 9 cows for one year was 5,610.7 lbs. of milk and 278.6 lbs. of butter. Records of individual cows are given. Four cows produced milk at an average cost of 5 cts. per gallon and butter at an average cost of 12½ cts. per pound. The average cost of food for the 4 cows per year was \$41.28 and the profit in milk was \$47.26 and in butter \$46.29. Two other cows produced milk at a cost of 3.7 cts. per gallon and butter at a cost of 8.37 cts. per pound. Shredded cornstalks was fed with bran and cotton-seed meal to one cow for one year. The cost of food was \$32.25, and the profit in milk \$39.01 and in butter \$43.43. The comparative value of cotton-seed hulls and pea-vine hay was tested with 2 cows during a period of 2 years. The nutritive ratios of the 2 rations were, respectively, 1:5.40 and 1:5.04. The results were in favor of the cotton-hull ration, the profits being \$9.26 greater per annum. "If the experiment serves no other purpose it shows the wastefulness of feeding an unbalanced ration."

The author discusses briefly the following topics: Georgia as a dairy State, dairying the foundation of diversified farming, cotton v. dairy farming, creameries, the future prospects of dairying in Georgia, and selection of a dairy herd.

Milk examination and milk control, O. BACH (*Ztschr. Untersuch. Nahr. u. Genussmtl., 3* (*1900*), *No. 12, pp. 819–824*).—Seventy samples of the milk supply of Mentz were examined for filth. The range per

liter of milk was from 3 to 42 mg., the majority of samples containing about 10 mg. of foreign matter. The bacteriological examination was equally unfavorable, it being "impossible to count the colonies on the plate cultures."

An apparatus devised by the author for determining the filth in milk is described and figured. This consists of a long cylinder, terminating in a narrow outlet tube at the bottom, which is connected by a rubber stopper with a test tube containing 2 or 3 cc. of water. The cylinder has two side tubes, one near the bottom and the other near the middle, each provided with rubber tubes closed with pinchcocks. The cylinder is closed at the upper end with a glass stopper. After the milk has stood 4 or 5 hours in the cylinder the upper part, including the cream, is drawn off through the middle side tube and the remainder through the lower one. The dirt collects in the test tube, only a small fraction remaining on the shoulder of the cylinder. The latter can be washed out into a beaker after removing the test tube. The dirt is collected on a weighed filter, washed with water, alcohol, and ether, and dried. The addition of a little concentrated ammonia to the milk aids the separation of the dirt. The author finds the apparatus gives more accurate results than any other he has tested.

Experiments with artificial cultures in making export butter, M. Grimm (*Selsk. Khoz. i Lyesov., 196 (1900), Mar., pp. 565–581*).—The author made experiments in ripening cream with pure cultures of *Bacillus acidi lactici* (Hueppe), the cultures of Severin (director of the bacteriological agronomical laboratory in Moscow), Hansen, Tvede, Blauenfeld, and Weigmann, and also with a culture of his own. The latter consists of a mixture of pure cultures of the following microorganisms: (1) A lactic-acid bacillus isolated from spontaneously soured milk and cream, resembling the *Bacterium lactis acidi* of Leichmann, (2) a coccus, and (3) a yeast.

The results of the experiments are stated as follows:

(1) The pure cultures of *Bacillus acidi lactici* (Hueppe) were found absolutely unfit for ripening export butter (Holstein butter). The taste of the butter was disagreeable, there was no aroma, and the acidity was high.

(2) The cultures of Severin gave a good butter with satisfactory keeping qualities, although the aroma was faint when pasteurized cream was used.

(3) The cultures of Tvede gave a butter with an agreeable, well-defined aroma, but not always of satisfactory keeping qualities.

(4) The cultures of Weigmann gave butter with an excellent aroma, but its keeping qualities were poor, although its density was normal. The number of bacteria producing the aroma exceeds that of the lactic-acid bacteria, the former preventing the full development of the latter.

(5) The cultures of Hansen gave excellent results in all respects.

(6) The author's culture gave butter with good flavor and aroma in all cases; the density was unsatisfactory in 2 cases (of a total of 6), and 2 samples did not keep well, owing, according to the author, to the fact that too young cultures were taken for the first ripening. In all other cases the keeping qualities were quite satisfactory.—P. FIREMAN.

Gassy curd and cheese, C. E. MARSHALL (*Michigan Sta. Bul. 183, pp. 193–205, figs. 9*).—A study was made of a bacillus resembling *Bacillus coli communis*, isolated from gassy curd. The production of gas in milk inoculated with this germ was very abundant and rapid at 37° C. The gas contained no oxygen. In one determination 99.1 cc. of the gas contained 76.96 cc. of carbon dioxid and 16.96 cc. of hydrogen. The nature of the remaining 5.18 cc. was undetermined. The appearance of cheese made from milk without the use of a starter, with the addition of a starter of the gas-producing bacillus, and with and without the addition of a lactic-acid starter to check the effect of the gas-producing bacillus is illustrated. The bacillus isolated by the author measured from 2 to 5μ in length and 0.5μ in diameter. It was frequently observed in short chains and was thought to be nonmotile. It stained with the common aniline stains, but not by Gram's method. The growth of the bacillus in bouillon and milk and on gelatin, agar, potato, oyster plant, parsnips, ruta-baga, sugar beet, onion, carrot, turnip, and red beet is described. The indol reaction was obtained. The optimum temperature was about 37° C. The bacillus was killed by heating to 60° C. for 10 minutes. Subcutaneous or intraperitoneal injections of 1 cc. of a bouillon culture were fatal to guinea pigs.

The bacterial flora of American Cheddar cheese: Its constancy and distribution, J. WEINZIRL (*Centbl. Bakt. u. Par., 1. Abt., 6 (1900), No. 24, pp. 785–791*).—Work by the author upon this subject has been previously noted (E. S. R., 11, p. 487). In the present experiment 62 samples of American cheese, 50 of which were Cheddar, were analyzed. These samples were from 8 States and Canada, and fairly represent the cheese belt extending from New York to Dakota. The ages of the known samples ranged from 2 to 450 days. The number of species of bacteria was found to be quite limited, being greatest when the cheeses were freshly made, and diminishing during and after the ripening period. Cheese 3 to 12 months old was frequently found to contain but a single species. Pure cultures of the bacteria were made by the usual method of dilution, and the results are reported in a table. A form which the author designates as *Bacillus lactis acidi* was found present in all samples, presenting an average of 74.2 per cent of the total bacterial content. Next in number was *B. acidi lactici* (Hueppe), with an average of 21.9 per cent, though it was absent in a few samples of very old cheese. These two forms constituted 96.1 per cent of the total bacteria found, and both

produced lactic acid abundantly, but did not digest the casein of milk. Another form of bacillus was of quite frequent occurrence, while a micrococcus was found more rarely. The two latter differ from the former in that they slowly peptonize gelatine, but they belong to the lactic-acid producing group.

Of the remaining bacteria, 5 produced no apparent change in the milk, and their presence in the cheese was regarded as accidental. Only 1 Bacterium, of which only a single colony was isolated, corresponds to Duclaux's Tyrothrix forms.

The author concludes that the lactic-acid producing group of bacteria play a most important rôle in the ripening of hard cheese. Their function can not be stated positively, but it is thought likely that they exert considerable influence upon the flavor. *B. acidi lactici* is a gas-producing organism, and when present in small numbers caused no bad effects, but in large numbers it produced the swelling which is highly detrimental to cheese.

The duration of the life of tubercle bacilli in cheese, F. C. Harrison (*Ann. Agr. Suisse, 1 (1900), No. 9, pp. 321–326*).—In this experiment milk was thoroughly inoculated with solutions of pure cultures of tubercle bacilli. Emmenthaler and Cheddar cheese were made from the milk in the usual way, using 10 liters for each cheese. From the time of manufacture average samples of the cheese were taken weekly. Equal amounts were macerated in sterilized water and guinea pigs were inoculated with the filtrate. The animals were examined weekly and their general appearance and weight noted. After six weeks or longer the animals were tested with tuberculin. In those diseased the temperature sometimes rose above 2°, while in the others it never exceeded 0.5°. After the test the animals were killed and autopsies made, in which the organs were closely examined with the microscope.

With the inoculations from Emmenthaler cheese from time of manufacture up to from 33 to 40 days tuberculosis developed in the guinea pigs. After 40 days from time of manufacture no evil results followed the inoculations, the bacteria in the cheese having evidently lost their virulence. In the Cheddar cheese the germinating power of the bacilli lasted 104 days, but after 111 days they were incapable of conveying the disease to guinea pigs by inoculation.

The author concludes that Emmenthaler cheese may be eaten with safety, as the period of ripening is much longer than the period during which the tubercle bacilli in the cheese are able to reproduce themselves. Cheddar cheese is seldom eaten under four months from time of manufacture, and during that time the tubercle bacilli become innocuous. However, in order to render the cheese absolutely safe, pasteurization of the milk is advisable.

Five samples of soft cheese were bought in the open market of Berne. The ages of these cheeses were unknown, but they were evi-

dently made within the last few days. Three of the samples conveyed tuberculosis to guinea pigs by inoculation and two did not.

Practical dairying, R. J. REDDING (*Georgia Sta. Bul. 49, pp. 177–205*).—The author discusses in a popular manner dairy cows in regard to breed and type, care of cows, stable management, milking, separating and ripening cream, churning, butter making, cheese making, feeding, dehorning, and other topics. Feeding standards and analyses of feeding stuffs are given. The calculation of feeding formulas is discussed and 19 rations for milch cows and 6 for fattening steers are suggested.

A popular discussion of pure milk supply, C. E. MARSHALL (*Michigan Sta. Bul. 182, pp. 173–191*).—The importance of pure milk for city trade and for the manufacture of butter and cheese is pointed out. Observations by the author on the condition of dairies and stables of different types are reported. Bacteriological experiments made to demonstrate the real significance of pure milk and polluted milk are described. Determinations of the germ content of milk drawn under different conditions are given. The cooling of milk, use of preservatives, inspection and care of cows, construction of stables and milking rooms, and various other phases of the subject are considered at length.

Milk inspection in Leipzig (*Sanitarium, 46 (1901), No. 375, pp. 140–144*).—A consular report of the rules and regulations governing the inspection and sale of milk in the city of Leipzig.

Cream testing, C. H. ECKLES (*Rpt. Iowa State Dairy Com., 14 (1900), pp. 55–68*).—A popular article on the Babcock test for cream, covering the points of sampling, testing, and sources of error.

Churn v. estimated results in butter making, M. A. O'CALLAGHAN (*Agr. Gaz. New South Wales, 11 (1900), No. 12, pp. 1135–1138*).—In 58 trials with milk averaging 3.88 per cent of butter fat the loss in manipulation was 0.23 per cent. With a ratio of 85 to 100 for calculating the amount of butter made from the butter fat 0.1 per cent too much was obtained over the calculated results by the Gerber test and 2½ per cent too much by the Babcock test.

Are the lactic acid producing or the Tyrothrix forms of bacteria the cause of the ripening and of the aroma of Emmenthaler cheese? L. ADAMETZ (*Milch. Ztg., 29 (1900), No. 48, pp. 753, 754*).—An experiment is described in which 10 cheeses were made with the use of pure cultures of *Bacillus nobilis* and 10 control cheeses without. The cheese was stored several months and was afterwards examined and scored. Those made with the pure cultures were of much superior flavor and aroma.

Dairy laws of California (*Rpt. California State Dairy Bureau, 3 (1899–1900), pp. 60*).—A reprint of statutes relating to the sale of dairy products and the inspection of dairies and dairy cattle.

National and State dairy laws, R. A. PEARSON (*U. S. Dept. Agr., Bureau of Animal Industry Bul. 26, pp. 110*).—This bulletin contains abstracts of National and State dairy laws now in force and the texts of laws enacted since 1898. The principal subjects on which dairy laws have been enacted in the United States and Canada and State standards for dairy products are shown in tables.

VETERINARY SCIENCE AND PRACTICE.

Two new pyogenic micro-organisms, E. KLEIN (*Centbl. Bakt. u. Par., 1. Abt., 28 (1900), No. 14–15, pp. 417–419*).—*Streptococcus radiatus* was found in the serous exudations of the diseased udder of a cow. This fluid injected into the body cavity of guinea pigs produced a

purulent inflammation within a few days and a local abscess was formed at the point of injection in which the micro-organism was found in short or long chains in small groups or in larger spheres. The organism is readily distinguished from *Streptococcus mastitidis*. *Bacterium diptherioides* was found in the purulent secretion of the udder of a cow. The udder was affected in only one quarter and the case had been diagnosed as tuberculosis of the udder. The author gives details of the behavior of this micro-organism on different culture media by means of which it is readily distinguished from the bacillus of diphtheria.

The hereditary transmission of tuberculosis, G. CARRIÈRE (*Arch. Med. Exper. et Anat. Path., Paris, 1. ser., 12 (1900), No. 6, pp. 782–787*). In order to determine the influences of tubercle toxins upon the constitution of the young of animals, the author conducted a number of experiments in inoculating guinea pigs. Five series of experiments were conducted in which the guinea pigs received the distilled product of cultures of the tubercle bacillus, the residue of the distillation of these cultures, an ether extract of the bodies of the tubercle bacillus, a toluol extract of the bodies of the tubercle bacillus, and a xylol extract of the same structures. The inoculations were given several months before the period of gestation began, and as a result of inoculation the young were born in diminished numbers and either dead or with feeble constitution. The author concludes from these experiments that tubercle toxins influence gestation in lessening the number of the young, in causing the death of the fetus, the premature death of the young, or a weakened constitution. Further experiments with young animals born under these conditions indicated that they are more sensitive to tuberculosis than normal animals.

Tuberculosis and its management, C. E. MARSHALL (*Michigan Sta. Bul. 184, pp. 207–266, figs. 7*).—Fifty specimens of milk secured from different parts of the State were tested for the presence of tubercle bacilli. Of these samples 16 came from cows which had reacted to tuberculin and in only one case was tuberculosis produced in guinea pigs from these samples. The milk of tuberculous cows at the college was frequently submitted to tests with the result that only one sample of tuberculous milk was found. This sample came from a cow which died a few days afterwards of generalized tuberculosis. A post-mortem examination of this animal showed the presence of the disease in the udder. Of 13 tuberculous cows which were tested for the presence of tuberculosis in the udder only one showed signs of the disease in this organ. In order to study the distribution of the tubercle bacillus in milk and its products, the author secured lung tissue from a tuberculous cow and mixed 1 lb. of the juice pressed from this lung with 120 lbs. of milk. This milk was then passed through the separator and subsequently an examination was made of the slime, the skim milk, cream, butter, and buttermilk which were obtained from the milk. The number of tubercle bacilli found in each of these

products is tabulated by the author. All of the products, including the expressed juice and the milk before separation, were used in inoculating guinea pigs, with the result that a virulent type of tuberculosis was produced in every case. Pigs fed with skim milk and buttermilk developed generalized tuberculosis within 6 months. The author believes that the milk of tuberculous cows may contain the tubercle bacillus and that this organism may find its way into all the milk products.

A number of experiments were conducted in feeding to pigs tuberculous meat in the form of glands. About 50 per cent of the pigs fed with such material developed tuberculosis. The author gives a detailed history of tuberculosis in the college herd since 1889, when the animals were first examined. All animals which gave a reaction to tuberculin on more than one occasion were subsequently shown to be tuberculous. The records of the herd show that the disease is seldom or never transmitted directly to offspring but that infection of calves usually occurs after a year or two. The author recommends that milk should be pasteurized by heating momentarily to a temperature of 85° C. or by subjection to a temperature of 68 to 70° C. for 20 minutes. The author's suggested method for managing tuberculosis is essentially that of Professor Bang.

New procedures in vaccination against symptomatic anthrax of cattle by association of an immunizing serum and virus, S. Arloing (*Compt. Rend. Acad. Sci. Paris, 131 (1900), No. 5, pp. 319–323*).—During experiments on sheep, it was found that an active immunity could be produced by inoculating with a dose of serum, followed by a dose of the fresh virus, but that it was impossible to rely upon analogous results from injections with a mixture of the virus and serum. When experiments along the same line were extended to cattle, it was found that more satisfactory results were obtained by inoculation with the mixtures. A certain amount of resistance was conferred upon cattle by inoculation with 1 cc. of serum mixed with 0.2 cc. virus, or with a mixture of 0.5 cc. serum and 0.2 cc. of virus. It is possible, therefore, to immunize cattle against blackleg by means of inoculation with the serum and virus, either separately or in mixtures.

Immunity to symptomatic anthrax after the injection of a preventive serum and natural virus, either separately or in mixtures, S. Arloing (*Compt. Rend. Acad. Sci. Paris, 130 (1900), No. 15, pp. 991–994*).—In a previous communication the author demonstrated the fact that blood serum from a strongly immunized cow confers a passive immunity upon sheep. The immunity produced by the injection of serum is of short duration. In the author's experiments it had entirely passed away by the eighth day. The immunity produced by serum may be strengthened and rendered more durable by subsequent inoculations with a lethal dose of fresh virus.

Experiments were tried in the production of immunity by means of injections with mixtures of the blood serum of immunized animals and fresh virus. Ten animals which were treated with different mixtures of these substances are reported upon by the author, and it appears that nine out of this number died when exposed to symptomatic anthrax.

The author concludes from his experiments that it is a comparatively easy matter to produce immunity in sheep by means of the injection of blood serum and later of active virus. No satisfactory results were produced, however, by injections of mixtures of the serum and virus in any proportions which were tried by the author.

The dissolution of the anthrax bacillus, G. Malfitano (*Compt. Rend. Acad. Sci. Paris, 131 (1900), No. 4, pp. 295–298*).—Degenerative forms of the anthrax bacillus have long been observed in old cultures or in cultures upon unfavorable media. Under such conditions, the anthrax bacillus dissolves rapidly and loses its form. Such dissolution is believed by the author to be a spontaneous process due to the presence of a proteolytic diastase in the cell. Cultures heated for 10 minutes at a temperature of from 55 to 60° C. dissolved more rapidly than those which are maintained at a normal temperature. A number of antiseptic substances, such as corrosive sublimate, formaldehyde, and cyanid of potash, kill the protoplasm of the bacillus, but hinder the action of diastases at the same time. The author believes that a number of unfavorable conditions may result in the same rapid action of the diastase found in the cell of the bacillus and in its consequent dissolution.

Investigations on the influence of the substratum upon the action of disinfectants toward the spores of anthrax bacillus, U. Otsuki (*Hyg. Rundschau, 10 (1900), No. 4, pp. 153–174*).—Cultures of anthrax bacillus were kept until abundant spore formation began to take place, when the material was brought in contact with the following substances and allowed to dry upon them: Silk threads, wool threads, pigeon feathers, rabbit hair, silk clothing, leather, wood of the fir tree, filter paper, cotton, glass beads, cover glasses, and garnets. The materials thus covered with the spores of anthrax bacillus were then subjected to disinfection by different methods, among which the most important were steam and a 5 per cent solution of carbolic acid. A table is given showing the different lengths of time that spores lived upon the different substances. The results of this study may be stated as follows: The resisting power of anthrax spores depends upon their origin and their age. The spores retain their resisting power unchanged for a long time, if kept dry at a low temperature. The temperature at which spore formation took place has no influence upon the resistance of the spores. The action of the disinfectants depends upon the structure of the materials upon which spores are dried. Spores which are attached to porous substances are

not so easily destroyed as those upon smooth surfaces. For purposes of study the best material on which to dry spores is pure quartz sand.

Notes on roup, H. W. MARSHALL (*Rhode Island Sta. Rpt. 1900, pp. 233-244*).—From diseased chickens 6 forms of bacteria were isolated in pure culture, and an experiment was conducted in attempting to inoculate other chickens by means of these cultures. During this experiment 12 hens were arranged in 6 pairs, and each pair received daily in drinking water a portion of one of the pure cultures. After 6 weeks of this treatment all the chickens remained healthy. The chickens from which the original roup material was taken were affected in the nostrils and eyes, but did not show any diphtheritic membrane in the throat. Both of these chickens subsequently died. Since it was suspected that the roup organism might develop more vigorously on a medium prepared out of chicken meat, the author used a medium known as rooster agar.

In order to determine the extent of natural transmission of roup, 6 pullets and 4 hens were confined with a roupy hen, and the eyes of the healthy fowls were rubbed daily with the exudate from the sick bird. All fowls were permitted to drink from the same receptacle. During 2 months 2 of the pullets died and 2 others showed slight swellings about the eyes. None of the 4 more vigorous ones became sick. The author made a microscopic examination of roup tissue taken from the eyes and throat of diseased fowls. Besides various bacteria found in this material, a smaller number of rounded, deeply stained bodies were distinguished, and it is suggested that these may prove to be some form of protozoa. An attempt was made to secure pure cultures of this round organism without success.

In order to obtain experimental evidence on the question of the identity of the roup organism with the diphtheria bacillus, a number of fowls were confined and fed daily with bouillon cultures of *Bacillus diphtheriæ*. After 6 weeks the fowls were killed and found to be free from diphtheria. Later 4 hens were inoculated subcutaneously with virulent cultures of the diphtheria bacillus, but no case of diphtheria was developed in the hens.

The susceptibility of certain species of animals to the organism of hemorrhagic septicæmia of ducks and chickens, A. RABIEAUX (*Compt. Rend. Soc. Biol. Paris, 52 (1900), No. 7, pp. 156-158*).—In ducks and chickens the disease is easily produced by ingestion of cultures or food substances in which the organism is mixed. Death takes place within from 30 to 48 hours without symptoms except diarrhea near the end of the period. In the pigeon death results within about the same length of time after eating cultures of this organism. The rabbit is very susceptible, and contracts the disease either by ingestion of the organism or by inhalation. In the latter case pulmonary lesions appear.

The disease can be transmitted to the guinea pig by ingestion, inhalation, or hypodermic injection. The white rat succumbs after about 30 hours to inoculation of pure cultures of this organism. In the dog the results of an inoculation are less constant. Intravenous inoculations are always fatal within from 30 to 72 hours. Frogs maintained at a temperature of from 25 to 28° C. succumb rapidly to hypodermic or peritoneal inoculations.

The repeated passing of the organism through animals increases its virulence. In the case of the rabbit it was observed that repeated passages through the rabbit increased the virulence of the organism for the rabbit, but did not alter its virulence toward the pigeon to a noticeable degree. Repeated doses of sterile cultures produced an immunity through a hypodermic inoculation in the rabbit and guinea pig.

Tests of various antiseptics, F. T. Bioletti (*California Sta. Rpt. 1898, pp. 170–173*).—An analysis was made of a substance called Puritine, for which high claims were made as to its antiseptic power. It was found not to contain chlorin and bromin, as claimed by the manufacturers. Puritine was compared with a number of other antiseptics, such as bittern water, aluminum sulphate, aluminum chlorid, boracic acid, and calcium chlorid. Various quantities of these antiseptics were placed in sterilized flasks containing ordinary beef bouillon, and they were then inoculated with putrefactive bacteria. The slight antiseptic power of Puritine was found to be due largely to the aluminum chlorid which it contained. This substance, however, was found to be far too expensive for practical application.

Sea water, to which aluminum sulphate was added in the proportion of 55 lbs. to 100 gal., was found to be an effective antiseptic in preventing decomposition, when used in the ratio of 18 gal. to 100 gal. of ordinary sea water. A test of an extract of California laurel (*Umbellularia californica*) showed that this substance had no appreciable effect in checking the growth of bacteria.

Alcohol fumes as a disinfectant, W. von Brunn (*Centbl. Bakt. u. Par., 1 Abt., 28 (1900), No. 10–11, pp. 309–315, figs. 2*).—The author conducted a number of experiments to determine the disinfectant power of alcohol fumes upon anthrax bacillus. The material used in these experiments came from agar cultures from three sources. The anthrax bacillus was dried upon the surface of silk threads and in this condition exposed to the action of fumes from alcohols of different concentration. It was found as a result of these experiments that 10 per cent alcohol has but little effect upon the anthrax bacillus, while a 25 and 50 per cent alcohol gave off fumes which were considerably more active. The best results were obtained from the fumes of a 75 per cent alcohol. When 95 per cent alcohol was used it was found that the fumes had no effect on the anthrax bacillus. These results indicate that alcohol fumes are most effective as disinfectants when mixed

with a certain percentage of water and that when the fumes contain a very small water content, as in the case of a 95 per cent alcohol, the spore membranes of the anthrax bacillus resist the action of these fumes for the reason that not enough water vapor is present to soften them.

Texas fever (*Arch. Wiss. u. Prakt. Thierh., 27 (1900), No. 1-2, pp. 41-85*).—This article contains a report to the veterinary service of Germany on the nature of Texas fever. A critical review is given of the American and other literature on the subject, and it is stated that further investigations are to be made for the purpose of determining whether Texas fever may be transmitted by the meat of diseased animals.

Cattle ticks and Texas fever, R. J. REDDING (*Georgia Sta. Bul. 49, pp. 228, 229*).—For preventing the development of Texas fever in northern cattle imported into the South, the author recommends the destruction of cattle ticks on southern pastures. It is urged that this can be accomplished by a rotation of crops and by an inspection of southern cattle twice each week. At such inspections the mature ticks can be removed by hand and the infested parts of animals may be rubbed thoroughly with a mixture of 4 lbs. axle grease to 1 lb. of kerosene and other similar mixtures.

Generalized tuberculosis, R. BURGGRAF (*Ztschr. Fleisch u. Milchhyg., 11 (1900), No. 3, p. 79*).—In one case of tuberculosis in the cow, it was found that a marked lameness which had been noted for some time before death was due to the presence of the tubercle bacillus in the body of one of the dorsal vertebræ.

Fetal tuberculosis, C. SCHROEDER (*Ztschr. Fleisch u. Milchhyg., 11 (1900), No. 3, pp. 79, 80*).—In the case of a cow which had tubercular lesions in the lungs, liver, spleen, and mammary gland, small tubercles were found in the portal, mediastinal, and bronchial glands and in the spleen of the fetus.

Regulations for the control of tuberculosis in cattle (*Tijdschr. Veeartsenijk. Maandblad, 28 (1900), No. 3, pp. 124-135*).—A detailed statement of government regulations concerning methods for preventing the spread of this disease.

A simple method of holding the thermometer during tuberculin tests, FRANK (*Deut. Thierärztl. Wchnschr., 8 (1900), No. 48, pp. 431, 432*).—According to this method of keeping a thermometer in place, a single stitch is taken in the animal tissue, which is said to require but little time and to hold the thermometer firmly.

The technique of taking the temperature during tuberculin tests in large herds of cattle, GRUNDMANN (*Deut. Thierärztl. Wchnschr., 8 (1900), No. 48, pp. 429-431, figs. 4*).—This article contains brief notes on the various factors which are concerned in giving reliable or unreliable results from tuberculin inoculations, and reports the results of the use of various mechanical devices for holding the thermometer in place.

Tuberculosis in horses, H. MARKUS (*Tijdschr. Veeartsenijk. Maandblad, 28 (1900), No. 3, pp. 97-113*).—The author gives a detailed description of the clinical symptoms and results of post-mortem examination and microscopical study of two cases of tuberculosis in horses. The temperature was somewhat elevated, reaching as high as 40.4° C. A number of tubercles were found in the spleen, the liver was somewhat enlarged, and the mesenteric and lumbar glands were affected. No gangrenous abscesses were found in the lungs. The tubercle bacillus was found in all pathological lesions. The evidence obtained from a study of these cases indicates that the focus of infection was located in the alimentary tract or its appendages.

Tuberculosis in pigs (*Jour. Agr. and Ind., South Australia, 4 (1900), No. 4, pp. 345, 346*).—A butcher purchased 11 pigs and fed them upon the offal from slaughtered cattle and sheep. Of these 11, 9 died after about 4 months, and the other 2 were diseased at the time of examination. An examination of these pigs showed the

presence of well marked tubercular nodules as large as pigeons' eggs in the lungs, and tubercles of various sizes in the liver. The lymphatic glands were also attacked. A bacteriological study of these tubercles determined the presence of the tubercle bacillus.

Experimental tubercular mammitis in the guinea pig, L. Nattan-Larrier (*Compt. Rend. Soc. Biol. Paris, 52 (1900), No. 37, p. 1024*).—By direct injection of the fluid containing the tubercle bacillus into the mammary gland of the guinea pig, it was found that a local tubercular abscess was produced within a short time. Indurated tuberculosis developed in the glands within from 4 to 5 days, and at the end of 2 weeks a true abscess was formed of considerable size. The experiments indicated that the mammary gland of the guinea pig, like that of domestic cows, is especially susceptible to this disease.

The influence of an inoculation of virulent tubercle bacilli in the dog upon the agglutinating power as determined by a previous inoculation of attenuated bacilli, S. Arloing and P. Courmont (*Compt. Rend. Soc. Biol. Paris, 52 (1900), No. 37, pp. 1025, 1026*).—The authors had previously noted that the serum of tuberculous animals in the last stages of the disease was often deprived of an agglutinating power toward the tubercle bacillus. Further experiments were conducted for the purpose of determining the cause of this phenomenon. During the study it was found that virulent bacilli injected into animals which were free from tuberculosis did not cause the appearance or increase of the agglutinating power, as was the case in inoculations with attenuated bacilli. Inoculations with attenuated tubercle bacillus in a dog produced a considerable increase of the agglutinating power and conferred upon this animal a certain resistance to subsequent inoculations with virulent bacilli. Virulent bacilli inoculated into dogs which had previously received attenuated bacilli caused a slight decrease in the agglutinating power.

Liver disease in calves, D. Hutcheon (*Agr. Jour. Cape Good Hope, 17 (1900), No. 10, pp. 602–605*).—The author reports a number of observations on this disease which indicate that it may be carried from farm to farm by affected calves. The disease appears to be of a contagious nature, but the pathogenic organism has not been isolated. Post-mortem examinations of calves dead of this disease show a congestion of the mesenteric blood vessels and a striking paleness of the muscular tissue, which emits a characteristic odor.

Kidney spot of calves, K. Vaerst (*Arch. Wiss. u. Prakt. Thierh., 27 (1900), No. 1–2, pp. 110–126, figs. 12*).—The author investigated the nature of certain white spots sometimes found on the kidneys of calves and often considered to be of a pathological nature. Such spots were found by the author to be normal phenomena occurring in about 5 per cent of slaughtered animals. The spots are believed to be due to certain processes in the development of the kidney from an embryonic condition. Experiments with unspotted and spotted kidneys indicated that the taste was not badly affected by the presence of the spots.

Diseases of sucking calves, C. O. Jensen (*Maanedsskr. Dyrlæger, 12 (1900), No. 8, pp. 297–306*).—The author gives a brief account of the diseases to which young calves are especially susceptible, and classifies them into the three groups—accidental diseases, infectious diseases, and digestive disturbances.

Combating hog cholera, U. De Mia (*Gior. R. Soc. Accad. Vet. Ital., 49 (1900), No. 50, pp. 1179–1183*).—The author reports the results of experiments in preventive inoculation against hog cholera. Vaccination according to the method of Perroncito was without harmful effects in any case, and produced favorable results in the immunity of treated animals. Of 21 hogs which were vaccinated in one locality, 1 died, while 19 out of 22 check animals died. In another place, 1 out of 15 vaccinated hogs died, while 6 out of the 19 check animals succumbed to the disease. The average mortality from vaccinated hogs according to the author's experience was 9.67 per 100, while that of untreated hogs was 33.68 per 100.

Protective inoculation against hog cholera, Foth (*Berlin. Thierärztl. Wchnschr., 1900, No. 48, pp. 566–568*).—The author reports the results of inoculating 4,909 pigs. The value of Landsberg and Prenzlau vaccines in actual cases of hog cholera is believed to be problematical. No reaction occurred in any of the cases of protective vaccination, and it was observed that hog cholera did not appear among herds which had been previously vaccinated with Susserin.

The sale and purchase of animals affected with contagious diseases, P. Bruno (*Gior. R. Soc. Accad. Vet. Ital., 49 (1900), No. 50, pp. 1187–1190*).—The author gives a brief discussion of the extent of traffic in diseased animals, and suggests the desirability of a law regulating this business.

The pathological anatomy of pigeon pox, P. Polowinkin (*Arch. Wiss. u. Prakt. Thierh., 27 (1900), No. 1–2, pp. 86–109, pl. 1, figs. 9*).—This disease has been known by a great variety of names, of which the author prefers *Epithelioma contagiosum*. The results of the author's investigations may be briefly stated as follows: The disease is of a benign nature and is not related to the smallpox of mammals. The swellings which are characteristic of the disease are to be considered as products of degeneration and not as tumors caused by parasitic organisms of animal nature. Microorganisms are found in these swellings, and the disease may be produced by inoculation of healthy birds with such organisms. The serum of pigeons which have recovered from the disease has the property of agglutinating the pathogenic organism.

TECHNOLOGY.

The manufacture of starch from potatoes and cassava, H. W. Wiley (*U. S. Dept. Agr., Division of Chemistry Bul. 58, pp. 48, pls. 8, figs. 17*).—This bulletin reports observations and data on the manufacture of starch from potatoes in Maine and other parts of the United States, together with descriptions of machinery and processes for the manufacture of starch from potatoes and cassava. The bulletin treats of the amount of potato starch produced, the soil, fertilizers, and methods of culture employed in regions where potatoes are grown for starch making, especially in Aroostook County, Maine, the chemical composition of the potatoes grown, the use of potatoes for alcohol making, the microscopic appearance and the uses of the starch produced; and of cassava as an article of food, microscopic forms of cassava starch, culture of cassava, plans for a cassava or potato starch factory, and present status of the cassava industry in Florida.

The total production of potato starch in the United States in 1899 was 15,500 tons, of which 9,000 tons was made in New Hampshire and Maine (6,000 tons in Aroostook County), 400 tons in New York, and 6,100 tons in Wisconsin and other Western States. The analyses reported show that the starch content of Maine-grown potatoes is not as large as that of potatoes ordinarily used for starch making in Germany and other parts of Europe. This is believed to be due to the fact that potatoes rarely mature naturally in Aroostook County, but the tops are usually killed by blight or frost. As a result the maximum starch is probably not developed.

The composition of American wines, W. D. Bigelow (*U. S. Dept. Agr., Division of Chemistry Bul. 59, pp. 76*).—This is a com-

pilation of 845 analyses made by the Division of Chemistry, and in various parts of the country, accompanied by statements regarding the interpretation of the analytical results and a description of the best methods now in use for the analysis of wines. Attention is called to the fact "that these analyses are not to be accepted in any way as expressing the quality of the American wines produced to-day by the competent wine makers in wineries conducted in accordance with the latest scientific principles of fermentation and ripening." The compilation is intended to be merely introductory to careful chemical studies of "all the typical American wines and their chief characteristics," which it is proposed to take up at once.

Report on the wines made from grapes grown on alkaline soils of Algeria, L. Roos, E. Rousseaux, and J. Dugast (*Ann. Sci. Agron., 1900, II, Nos. 2, pp. 276–320; 3, pp. 321–337*).—The author concludes from an extensive series of observations that vines growing on alkaline soils may produce grapes containing a high percentage of chlorid without showing any symptoms of injury themselves. Different investigators have maintained that 0.2 to 0.35 gm. of sodium chlorid per liter is the maximum content for normal wine, but the author has observed much larger proportions of the chlorid without any accompanying injury to the vines. There was no constant relation between the proportion of chlorids in the wine and in the soil on which the grapes were grown, nor between the chlorin and the other constituents of the wine. The amounts of the various saline substances in the grapes seemed to be determined very largely by the climatic conditions, vigor of growth of the vines, etc. The author is of the opinion that the salts are contained mainly in the seeds.

Wattle barks for tanning, J. H. Barber (*California Sta. Rpt. 1898, pp. 227–230*).—This article gives measurements of typical trees, tannin content of the bark of stems, branches, and large roots, and practical tanning tests of the bark of tanbark acacias (*A. pycnantha*, *A. decurrens*, and *A. mollissima*), planted at the forestry station at Santa Monica. The results of the tanning determinations are given in the following table:

Determinations of tanning material in black and golden wattles.

	Water in air-dried substance.	Tannin.	
		Air-dried substance.	Water-free substance.
Acacia decurrens (Black Wattle):	*Per cent.*	*Per cent.*	*Per cent.*
Bark from main stems	6.53	42.48	45.83
Bark from branches	8.26	36.57	39.98
Bark from large roots	5.28	31.35	33.10
Acacia mollissima (Black Wattle):			
Bark from main stems	7.60	45.98	49.76
Bark from branches	8.02	42.98	46.66
Bark from large roots	7.89	32.37	35.18
Acacia pycnantha (Golden Wattle):			
Bark from main stems	9.32	41.80	46.09
Bark from branches	8.67	38.66	42.34
Bark from large roots	7.10	47.02	50.58

Practical tests of the barks in tanning "light russets" from sheepskins gave the following results: One hundred pounds of air-dried bark of *A. decurrens* tanned 106 lbs. of leather, while the same amounts of *A. mollissima* and *A. pycnantha* bark tanned 112 and 96 lbs., respectively. These results coincide approximately with the relative percentages of tannin found by analysis of the air-dried barks.

Uses of wood pulp (*Special U. S. Consular Rpts., 19 (1900), pp. 517*).—A series of reports are given on the uses and manufacture of wood pulp in various countries.

The use of grape leaves for imparting special aromas to wines, N. PASSERINI and P. FANTECHI (*Staz. Sper. Agr. Ital., 33 (1900), No. 5, pp. 436–440*).—A number of experiments are reported in which extracts of grape leaves from well-known varieties were added to the fermenting must of wines in order to ascertain the validity of the claim that the flavor and bouquet of wine could be influenced in such a manner. So far as these experiments go, there seems to be nothing to indicate that the aroma which characterizes certain varieties of Italian wines could be imparted to other wines by the addition of extracts from the leaves.

The influence of temperature, acidity, and density of must on its fermentation by various ferments, G. GELM (*Staz. Sper. Agr. Ital., 33 (1900), No. 2, pp. 172–182*).

Rational methods of vinegar making and their control, J. BERSCH (*Der rationelle Betrieb der Essig-Fabrication und die Controle derselben. Vienna, Pesth, Leipsic: A. Hartleben, 1900*).

The raw materials of the plant kingdom, J. WIESNER (*Die Rohstoffe des Pflanzenreiches. Leipsic: W. Engelmann, 1900, ed. 2, rev. and enl., vol. 1, pp. 795, figs. 153*).

STATISTICS—MISCELLANEOUS.

Annual Report of California Station, 1898 (*California Sta. Rpt. 1898, pp. 367*).—This contains the organization list of the station; a financial statement for the fiscal year ended June 30, 1898; a report of the director; discussions on preparatory teaching in agricultural colleges, by E. W. Hilgard, and on farmers' institutes, by E. J. Wickson; miscellaneons articles abstracted elsewhere; lists of donations and exchanges; brief abstracts of several bulletins of the station; and reprints of Bulletin 119 of the station on vine pruning (E. S. R., 9, p. 949), of Bulletin 124 of the station on lupines for green manuring (E. S. R., 11, p. 534), and of a station circular on the extermination of weeds (E. S. R., 12, p. 350).

Eighteenth Annual Report of New York State Station, 1899 (*New York State Sta. Rpt. 1899, pp. 503*).—This contains the organization list of the station, a financial statement for the year ended September 30, 1899, a meteorological record noted elsewhere, and reprints of Bulletins 158–173 of the station on the following subjects: Combating the striped beetle on cucumbers (E. S. R., 11, p. 269); the forest tent caterpillar (E. S. R., 11, p. 865); report of analyses of commercial fertilizers for the spring of 1899 (E. S. R., 11, p. 917); treatment for gooseberry mildew (E. S. R., 11, p. 945); leaf scorch of the sugar beet, cherry, cauliflower, and maple (E. S. R., 11, p. 1058); the New York apple-tree canker (E. S. R., 12, p. 59); notes on various plant diseases (E. S. R., 12, p. 55); report of analyses of Paris green and other insecticides (E. S. R., 12, p. 67); commercial feeding stuffs in New York (E. S. R., 12, p. 169); a fruit-disease survey of the Hudson Valley in 1899 (E. S. R., 12, p. 154); director's report for 1899 (E. S. R., 12, p. 198); fertilizing self-sterile grapes (E. S. R., 12, p. 240); common diseases and insects injurious to fruits (E. S. R., 12, p. 271); animal food for poultry (E. S. R., 12, p. 276); the efficiency of a continuous pasteurizer at different temperatures (E. S. R., 12, p. 287), and report of

analyses of commercial fertilizers for the fall of 1899 (E. S. R., 12, p. 226). The detailed analyses of commercial fertilizers are omitted in the reprints of Bulletins 160 and 173.

Nineteenth Annual Report of Ohio Station, 1900 (*Ohio Sta. Rpt. 1900, pp. XXV*).—This contains the organization list of the station, a financial statement for the fiscal year ended June 30, 1900, and a report of the director reviewing the work of the station during the year, discussing the relation of the station to the agriculture of the State, and giving a list of acknowledgments.

Annual Report of Oregon Station, 1896 (*Oregon Sta. Rpt. 1896, pp. 16, 17, 19–21, 27, 28*).—These pages contain notes on the work and needs of the station and a financial statement for the fiscal year ended June 30, 1896.

Annual Report of Oregon Station, 1898 (*Oregon Sta. Rpt. 1898, pp. 15–68*).—This contains a brief review of station work by the director; a financial statement for the fiscal year ended June 30, 1898; a report of the agriculturist reviewing the work of the year and summarizing the results of experiments reported in previous publications of the station (E. S. R., 9, p. 867; 10, pp. 635, 674, 675, 684, 686); a report of the chemist, noted elsewhere; a report of the entomologist, giving notes on various insects studied during the year; a report of the botanist, giving brief notes on Oregon weeds, plant diseases, native clovers, parasitic fungi, etc.; and a report of the horticulturist outlining the experiments undertaken during the year.

Annual Report of Oregon Station, 1899 (*Oregon Sta. Rpt. 1899, pp. 13–36*).—This includes a report of the director, a financial statement for the fiscal year ended June 30, 1899, and reports of the heads of departments reviewing the different lines of station work, and giving briefly some of the results obtained. The report of the chemist is noted elsewhere.

Annual Report of Oregon Station, 1900 (*Oregon Sta. Rpt. 1900, pp. 12, 13, 17–32*).—This includes a report of the director, a financial statement for the fiscal year ended June 30, 1900, and outlines of station work by the heads of departments. Experiments with sorghum are noted elsewhere.

Thirteenth Annual Report of Rhode Island Station, 1900 (*Rhode Island Sta. Rpt. 1900, pp. 203–383*).—This includes the organization list of the station; a report of the director reviewing the work of the station during the year and giving notes on the annual meeting of the Association of American Agricultural Colleges and Experiment Stations; a list of station publications during the year and notes on the station staff; departmental reports reviewing in detail the different lines of station work and containing articles noted elsewhere in this issue; a financial statement for the fiscal year ended June 30, 1900, and list of donations, exchanges, and of the publications of the station since its organization.

Annual Reports of the Department of Agriculture, 1900 (*U. S. Dept. Agr. Rpts. 1900, pp. 297*).—Executive reports.

Press bulletins (*Ohio Sta. Bul. 120, pp. 263–274*).—This includes reprints of the press bulletins issued during the year which have not already been incorporated in the regular bulletins. Following are the subjects treated: Stomach worms in sheep, a comparison of factory-mixed and home-mixed fertilizers, fall treatment of insect pests, fall plowing *v.* white grubs and wireworms, free distribution of sorghum seed, comparison of varieties of potatoes, the soy bean a substitute for clover, spring treatment of fields where wheat has been destroyed by the Hessian fly, the onion thrips, San José scale, tree and plant diseases, the cankerworm, suggestions to orchardists for destroying the San José scale, and black knot and peach yellows.

Announcement to New Mexico ranchmen and list of bulletins, F. W. SANDERS (*New Mexico Sta. Bul. 36, pp. 29–32*).—Brief statements relating to the equipment and work of the station, a subject list of station publications, and the organization list of the station.

NOTES.

Kansas College and Station.—Herbert F. Roberts has been appointed botanist to succeed A. S. Hitchcock, resigned. The legislature has made a total appropriation for two years of $202,253.40. Of this amount $20,493.40 is made immediately available, $5,000 being for the purpose of refitting the old chemical building, recently burned, for a gymnasium, and nearly $15,000 to cover a deficiency occurring in the fiscal year 1899. Seventy thousand dollars is given for a new physics and chemistry building, and $10,000 for additions to the library. The farm department receives $7,000 in 1902 and $2,000 in 1903, and $2,000 a year is given for farmers' institutes. These liberal appropriations will place the college in better financial condition than it has ever been before. Last year a bill passed Congress granting to the State of Kansas the abandoned Fort Hays military reservation, located in Ellis County, for the purpose of establishing an experiment station there under the supervision of the State station, and a western branch of the State normal school. The State legislature has accepted the reservation and has appropriated to the college $3,000 a year for two years for carrying on experimental work. The reservation contains 7,600 acres of land, and represents the different soils and other conditions of western Kansas. It is thought to give "the finest opportunity ever offered for field tests on a large scale that are applicable for the farmers of the entire western half of the State."

Minnesota University and Station.—In addition to appropriations for current expenses of the department of agriculture and the substations at Crookston and Grand Rapids, the legislature which has just adjourned appropriated $25,000 for a new chemical building, $25,000 for a new veterinary building, $12,000 for an addition to the women's dormitory, $7,500 for a building for instruction and experiments in dressing and curing meats, $3,000 for buildings for swine breeding, $3,000 for an addition to the blacksmith shop, $3,000 for improvements in the dairy hall, and $11,200 for barns and other improvements at the substations at Crookston and Grand Rapids. An annual appropriation of $2,000 for two years was also made for the introduction of agriculture into the rural schools of the State.

Missouri University and Station.—The State legislature has just made the largest appropriation ever given the university, aggregating $467,400 for the biennial period. It provides $40,000 for a dairy and live-stock building, and an equal amount for a horticultural building and equipment. A medical building, an engineering building, and a dormitory for girls are also provided for. A chair of dairy husbandry is established, $1,200 given for student labor on the farm, and $3,500 to the experiment station toward general maintenance. The legislature also made liberal appropriations for libraries and laboratories, out of which the College of Agriculture will receive its share, making, all told, over $100,000 for agricultural interests.

Missouri Fruit Experiment Station.—The State legislature has appropriated $26,000 for this station for two years, which includes about $6,000 for permanent improvements of buildings and grounds and the remainder for salaries, traveling expenses, labor, printing, and material for work.

New Hampshire College and Station.—Clarence W. Waid has resigned his position as assistant horticulturist to accept a similar position at the Ohio Station,

and Harry F. Hall has been appointed to succeed him. Wm. F. Fiske has resigned the position of assistant entomologist to accept the position of assistant State entomologist in Georgia. The legislature at its last session appropriated $30,000 for an agricultural building for the college, which will contain lecture rooms, laboratories, and offices for the departments of agriculture and horticulture.

New Mexico Station.—Herbert B. Holt, of Las Cruces, has been appointed regent in place of P. Moreno.

Oklahoma Station.—The term of W. E. Bolton as member of the board of regents having expired, H. C. R. Brodboll, of Ponca City, has been appointed. The legislature has appropriated $8,000 for buildings. Of this sum, $6,500 will be expended in the construction of a barn and farm fences, and the balance for many minor improvements on existing buildings. By a recent decision of the court, a levy of three-tenths mill for the year 1901 and four-tenths mill for the year 1902, estimated to yield $46,000, is made available for the use of the college. The money will be expended in the construction of an engineering building, and an addition to the library building providing for an assembly hall and quarters for the departments of botany and entomology in the college and station.

South Carolina Station.—L. A. Sease has been elected a member of the board of trustees, *vice* W. H. Mauldin, deceased.

Washington College and Station.—The last legislature appropriated $60,000 for maintenance, $1,000 for the purchase of live stock, $25,000 for building and equipping a chemical laboratory, $10,000 for an armory, $1,500 for the library, $1,000 for greenhouses and insectary, $4,000 for additions to the central heating plant, $300 for museum cases, $1,500 for miscellaneous improvements, $10,000 for a water system, $5,000 for a sewer system, a small amount for a ward for contagious diseases in the veterinary hospital, and $10,000 for the substation at Puyallup, of which $2,000 is for improvement. W. H. Heileman has resigned as assistant chemist of the station to become a field agent in the Division of Soils of this Department.

West Virginia University and Station.—President J. H. Raymond has resigned his position and gone abroad for a time. On his return he will go to Chicago University as associate professor of sociology engaged in university extension work. The last legislature repealed the laws under which the boards of all the State institutions, including the university and experiment station, had been appointed, and passed new laws providing in the case of the latter institutions for the appointment of a board composed of six persons of the party in power and three of the minority. The board of regents resigned after accepting the resignation of President Raymond. The new board is constituted as follows: E. M. Grant, of Morgantown; C. E. Haworth, of Huntington; J. W. Hale, of Princeton; Chas. M. Babb, of Falls; J. R. Trotter, of Buckhannon; D. C. Gallagher, of Charleston; J. B. Finley, of Parkersburg; Chas. D. Oldham, of Moundsville; W. J. W. Cowden, of Wheeling. A new fertilizer law has been passed providing a tonnage tax of 40 cts., and requiring manufacturers to make affidavit as to the source from which materials composing their fertilizers are derived. A San José scale law, which is practically the same as the Ohio law, has also been passed.

Personal Mention.—The formal presentation of a bronze medal to Dr. S. M. Babcock, by the State of Wisconsin, as a mark of appreciation of his services to dairying in the invention of the milk test which bears his name, occurred March 28, 1901, at a joint session of the State senate and assembly. Governor La Follette presided, and in a brief address paid a graceful tribute to Dr. Babcock's skill as an investigator and his generosity in giving his invention to the country. O. H. Fethers, a member of the committee appointed to select the medal, made the presentation. The medal bears the following inscription: "Recognizing the great value to the people of this State and the whole world of the inventions and discoveries of Prof.

Stephen Moulton Babcock, of the University of Wisconsin, and his unselfish dedication of these inventions to the public service, the State of Wisconsin presents to Professor Babcock this medal." In his response Dr. Babcock attributed the opportunity for carrying on the investigation which led to his discoveries to the wise bounty of the State in establishing and maintaining institutions for research. The principal address was made by ex-Governor W. D. Hoard, who pointed out the important relation existing between science and practice in agriculture, and laid great emphasis upon the value of Dr. Babcock's discovery and its world-wide application and introducti... He compared it to the iron plow, the reaper, and the thrashing machine in marking a distinct step of progress in agricultural advancement. He cited it as a notable instance of the value of research, and urged the encouragement of such work along fundamental lines. "The great necessity of the hour with the farmers of Wisconsin is a better knowledge of the laws which must govern the outcome of their labor. The wisest among them see this, feel it, and in their work as farmers endeavor to be governed by this necessity. The leading thought and purpose of all our citizens then should be to so upbuild, establish, and strengthen the cause of agriculture in Wisconsin that knowledge, skill, training, and broad judgment of the relation of things shall direct the hand that labors."

Prof. F. E. Emery, formerly connected with the North Carolina Station, has been appointed special agent of the Dairy Division, Bureau of Animal Industry, of this Department, to investigate dairy interests in China, Japan, and the Philippines, with reference to increasing the sale of American dairy products in these countries.

John A. Myers, of New York, died from typhoid fever, after a brief illness, April 8, 1901. Dr. Myers was born in West Virginia in 1853. He served successively as tutor in chemistry at Bethany College, professor of chemistry and physics in Butler University, Kentucky University, and in the Mississippi Agricultural and Mechanical College, and was State chemist of Mississippi for six years. In 1888 he was appointed director of the West Virginia Experiment Station, which position he occupied until 1897. He then assumed charge of the propaganda for nitrate of soda, which position he occupied at the time of his death. Dr. Myers was widely known among experiment station workers in this country, and took an active interest in the experiment station movement from its inception.

E. S. Nettleton, agent and expert in connection with the irrigation investigations of this Department, died at Denver April 23, 1901. Colonel Nettleton had been prominently identified with irrigation enterprises for many years and was the author of several works on irrigation problems. A bulletin prepared by him on the Reservoir System of the Cache la Poudre Valley was recently issued by this Department.

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EXPERIMENT STATION RECORD.

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EXPERIMENT STATION RECORD.

VOL. XII. No. 11.

The preliminary operations of the Hawaii Experiment Station have been actively entered upon. Since his arrival Mr. Jared G. Smith, the special agent in charge of the station, has devoted himself primarily to the final steps necessary for securing a site for the station, and familiarizing himself with the general conditions. The station is to occupy a tract of land known as Kewalo-Uki in Makiki Valley on the island of Oahu. The land extends from the Punchbowl, in the suburbs of Honolulu, along the east slope of the volcanic ridge, rising from about 100 feet to nearly 1,400 feet in a distance of 2 miles. The lower slope is densely covered with thickets of lantana, with scattering groups of *Prosopis juliflora* and *Opuntia tuna*; the upper third is covered with a planted forest of Australian Eucalyptus, Acacia, and Grevillea species. A site for the headquarters and residence buildings has been definitely decided upon, and it is expected that considerable progress toward the erection of the buildings will be made by July 1. Contracts have been let for the clearing of other portions of the tract, which will furnish a large amount of fire wood and sufficient fence posts for inclosing the whole tract.

Mr. Smith writes that one of the most important lines of work to be taken up at once is that of providing forage and pasturage, as hay is imported in large quantities from California and retails at from $27 to $35 a ton in Honolulu. This work will be preliminary to feeding experiments and other experiments in animal production, to be taken up later. A trial will be made of ensiling the cane tops for use as fodder, as at present the sugar planters dry these tops and burn them, and buy hay from California. Another important line of work will be the establishment of new agricultural crops. The great need appears to be for something which can be grown by men of limited means and for which there is already an established world's market, as the Honolulu market is a limited one and is easily glutted. An effort will be made to find varieties of citrus fruits especially adapted to the locality and which will ripen before the California oranges are ready. All of the oranges and lemons used in the islands are at present imported from California, oranges retailing at 5 cents apiece and lemons at 25 cents a dozen. The pomelo grows well and is of good quality. Limes

thrive better than any other citrus fruits, but even these are not raised in sufficient quantity to supply the local market.

There is a troublesome disease among chickens which is said to render it almost impossible to raise poultry in the islands. Many unsuccessful attempts on a large scale have been made. The practical effect of this is well illustrated by the high price of poultry products. Mr. Smith states that a lot of live fowls from California sold recently at auction for $1.85 each, and that eggs retail at 60 cents a dozen. A suitable poultry feed appears to be another problem, as at present rice is the only grain obtainable for that purpose.

There are several small industries being started, which the station may be able to assist. One is the raising of pineapples for canning purposes, and another banana drying and the manufacture of banana flour.

The outlook for cooperative experiments on all the islands seems to be good, as the people are taking a great interest in the work. It seems evident that as the station develops abundant opportunity will be offered for it to render valuable service to the agriculture of the islands apart from the questions related to sugar production.

Maxime Cornu, whose death occurred recently at Paris, was eminent as a botanist, horticulturist, and agriculturist, and made important economic contributions in each of these lines. He was born at Orleans, July 16, 1843, and received his doctor's degree in 1872, his thesis being a monograph of the Saprolegniaceæ, for which he was awarded the Desmazieres prize of the French Academy of Science. His earlier work was largely in the study of plant diseases and means for their prevention, and in some of these investigations he was truly a pioneer. He became connected with the Museum of Natural History in 1874, and in 1884 succeeded Decaisne as director of cultures at the Jardin des Plantes. Under his direction the plan of the gardens was entirely changed and its scope enlarged. Special efforts were put forth to make the collections of living plants more complete, and in carrying out this plan many little-known species were introduced from various countries, especially from the French colonies. In 1887 he caused to be established a course in colonial cultures. This was the first well-organized attempt made in Europe to secure the study of economic plants of various colonies, and as an outgrowth of this beginning the French Government established in 1897 a garden or station for colonial studies, with a central station maintained in France and branch stations in the different French colonies.

M. Cornu was a member of many learned societies, official commissions on horticulture and agriculture, and the superior council of agriculture, and was the official representative of his Government at numerous international congresses. At a conference held in Berne in

1881 he succeeded in securing an agreement regarding international commerce and exchange in horticultural products. Outside of France M. Cornu is best known by his investigations in vegetable pathology. He took a prominent part in working out the phylloxera problem in France, and has published observations upon many other plant diseases. He was one of the earliest investigators to determine the relationship between the cedar apple and the rust occurring on pear and apple leaves. His publication on this subject dealt with *Gymnosporangium sabinæ* on juniper, and *Rœstelia cancellata* on pear leaves. The alternate generation of *Puccinia coronata* on oats and the æcidial stage of the fungus on the buckthorn were also pointed out. Among other of his investigations were those on the grape mildew and anthracnose, lettuce mildew, pine-leaf rust, hollyhock rust, onion smut, etc. Most of the publications relating to these investigations were issued before he assumed the directorship, as his studies in plant introduction fully occupied him during recent years.

This issue concludes the twelfth volume of the Record, except the index number, which will be No. 12, as usual. The latter is in course of preparation, and is well under way, but will not be ready for distribution for some little time. In the meantime the new volume will be entered upon. A smaller type has been adopted for this, which will enable a considerably larger number of abstracts to be included in each number without increasing the number of pages. By this means it is hoped that the publication of the abstracts may be kept somewhat more closely up to date.

Good progress has been made in the work on the combined index to the first 12 volumes of the Record. The preliminary work on this is approaching completion. Even with the condensation which has been adopted it includes upward of 100,000 separate entries. The combining of these so as to bring all related references together under suitable general entries, in order to make it a practical working index, together with the final editorial work and proof reading, will probably require several months. Although a laborious and expensive undertaking, it is believed that the product will justify this in furnishing a full subject index to experiment station work since the passage of the Hatch Act, and to a very large proportion of the contemporaneous investigation along lines related to agriculture.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

A simple method for determining phosphoric acid by means of molybdic solution, J. Hanamann (*Ztschr. Landw. Versuchsw. Oesterr.*, *3* (*1900*), *pp. 53–62; abs. in Chem. News*, *83* (*1901*), *No. 2145*, *p. 12*).—The author finds that at 40° C. the precipitation can be completed in 10 minutes, even in the presence of solutions containing a considerable quantity of iron, by using a molybdic solution strong in nitric acid. The precipitate filters easily, washes rapidly, and does not adhere to the sides of the beaker. By gently calcining the yellow phosphomolybdate of ammonium at a uniform temperature not above a certain point, a deep blue colored compound of constant composition is obtained, containing, according to Meinecke, 3.94495 P_2O_5. If after calcination the precipitate has not the characteristic deep blue color it should be moistened with ammonia, dried and again calcined.

The molybdate reagent is prepared as follows: One hundred grams molybdate of ammonia is dissolved in 150 cc. of ammonia of 0.91 sp. gr., in the presence of 100 gm. of ammonium nitrate. The solution is poured into a liter of nitric acid, sp. gr. 1.2, boiled, filtered, and kept in a brown bottle in a cool place.

The determination of potash by means of perchloric acid for commercial purposes, C. Montanari (*Staz. Sper. Agr. Ital.*, *33* (*1900*), *No. 5*, *pp. 454–462; abs. in Chem. Centbl.*, *1901*, *I*, *No. 3*, *p. 203; Chem. Ztg.*, *25* (*1901*), *No. 20*, *Repert.*, *p. 68*).—The reagent used is prepared as follows: Commercial sodium perchlorate, 100 gm., is shaken with 150 gm. of pure concentrated hydrochloric acid. The solution is filtered through glass wool and the hydrochloric acid evaporated. In this way a moderately concentrated solution of perchloric acid, or of perchloric anhydrid, is obtained. A solution of the potash salts freed from ammonium salts, containing about 0.5 gm. of the potash salts, is acidified with hydrochloric acid, an acidified solution of barium chlorid added, the solution filtered, and the filtrate evaporated to 15 to 20 cc. To this 1 cc. of the perchloric acid solution is added and again evaporated to a sirupy consistency. After cooling, about 20 cc. of 95 per cent alcohol containing 2 per cent by volume of perchloric acid solution is added with stirring. After standing 2 hours

the solution is filtered through a Gooch crucible, washed with alcohol containing perchloric acid until the washings amount to 60 to 70 cc., then with a few cubic centimeters of 90 per cent alcohol. The crucible is dried in the air bath for 20 to 25 minutes at 120 to 130° C., then washed with hot water, dried, and weighed again. The difference in the two weighings gives the amount of pure potassium perchlorate. From this the potash may be calculated by the factor .3402. The results by this method were found to be, on an average, 0.258 per cent lower than those obtained by the platinum chlorid method.

A method for preparing normal, seminormal, decinormal, etc., sulphuric acid of exact strength, R. K. MEADE (*Jour. Amer. Chem. Soc., 23 (1901), No. 1, pp. 12–15*). The method of Hart and Croasdale of making a standard sulphuric acid solution by the use of the electric current was found by the author to be accurate, and needs no checking except against errors of manipulation. By this method the electric current is passed through a solution of copper sulphate. The salt is decomposed, the sulphuric acid separating at the anode and remaining in solution. Very accurate results were obtained in making standard acids of various strengths.

A very delicate reaction for determining the presence of formaldehyde and of milk sugar in milk, E. RIEGLER (*Pharm. Centralhalle, 40 (1900), pp. 769, 770; abs. in Chem. Centbl., 1901, I, No. 3, p. 206*). In testing milk for formaldehyde, phenylhydrazin and a 10 per cent solution of soda is added to a small portion of the diluted milk. In the presence of even 2 drops of formaldehyde to 100 cc. of milk, a rose color will result. In normal milk no color is produced. In determining the presence of milk sugar, a small amount of sodium acetate is added in addition to phenylhydrazin and 10 per cent soda solution, as in the previous case. A rose color will result in the presence of milk sugar.

A note on the examination of butter and other fats, A. REYCHLER (*Bul. Soc. Chim. Paris, 3. ser., 25 (1901), No. 2, pp. 142–144*).—Comparisons are made between the total volatile and the volatile and soluble fatty acids of butter, cocoanut oil, oleomargarine, neutral lard, and mixtures of the same. These results are presented in a table, and from the ratio of the volatile and soluble acids to the volatile acids a third column is drawn, which may be used to determine the nature of fats containing large amounts of volatile acids.

Theine in tea, J. KOCHS (*Rev. Cult. Coloniales, 7 (1900), No. 59, p. 494; abs. in Jour. Soc. Chem. Ind., 20 (1901), No. 1, p. 58*). The percentage of theine in the teas examined was as follows: Souchong, 2.83; Flower Pekoe, 4.36; Scented tea, 3.08; Pouchong, 3.44; Congou, 3.83; Oolong, 3.66; Cha Morumby, a Brazilian tea, 3.11. The quality and value of tea does not depend alone upon the composition, but also upon the appearance, aroma, and taste of both the leaf and the infusion.

The nature and properties of corn oil, H. T. VULTE and HARRIET W. GIBSON (*Jour. Amer. Chem. Soc., 23 (1901), No. 1, pp. 1-8*). The investigation reported endeavors to identify the series of fatty acids contained in maize oil. This oil is made up of a complex mixture of glycerids of the fatty acids, a small percentage of volatile oil, and a larger percentage of unsaponifiable matter. Attention is called to the almost insurmountable difficulties, owing to the lack of a definite scheme of analysis, in obtaining accurate knowledge of the properties of the fatty acids.

The methods employed in the present investigation are given, and in the case of previously known constituents, the results are compared with those of other investigators.

In studying the soluble fatty acids, a portion of the aqueous liquid was heated with alcohol and concentrated sulphuric acid. The characteristic odor of ethyl acetate was produced, indicating the presence of acetic acid. By the silver nitrate test the presence of formic acid as determined by Rokitiansky, was confirmed. Further research is needed to prove the presence or absence of caproic, caprylic, capric, and ricinoleic acids in corn oil. The authors conclude that the present investigation adds to the known constituents of the oil, acetic, hypogaeic, and arachidic acids.

A method for determining sesame oil in vegetable and animal oils, TAMBON (*Jour. Pharm. et Chim., 6. ser., 13 (1901), pp. 57, 58; abs. Chem. Centbl., 1901, I, No. 7, p. 422*). To 15 cc. of the oil there is added 7 to 8 cc. of a reagent composed of 3 to 4 gm. of chemically pure crystallized dextrose in 100 cc. of hydrochloric acid. The mixture is shaken 2 or 3 minutes, heated to boiling, again shaken, and the color noted. In the absence of sesame oil, the mixture remains colorless. In the presence of 1 to 5 per cent of sesame oil, a beautiful rose-red color is produced, with violet streaks turning to a cherry red. Ten per cent of sesame oil gives a red color. The same reaction is obtained with the fatty acids of the sesame oil.

Rock analysis, W. F. HILLEBRAND (*Bul. U. S. Geol. Survey, No. 176, pp. 114 + XIII, figs. 15*).—This is a revised edition of the first part of Bulletin 148 of the Survey, giving descriptions of methods and apparatus used in the laboratory of the Survey for the complete mineral analysis of rocks, minerals, etc.

Recent work in soil analysis, H. G. SÖDERBAUM (*Kgl. Landtbr. Akad. Handl. Tidskr., 39 (1900), No 4, pp. 267-274*).

On the citrate-solubility of the phosphoric acid of bone meal, T. METHNER (*Ztschr. Angew. Chem., 1901, No. 6, p. 134*). The average solubility of the phosphoric acid of 6 samples of bone meal ($2\frac{1}{2}$ gm. of the bone is 500 cc. of 2 per cent citric acid) was 95.75 per cent.

The valuation of gas liquor, F. J. R. CARULLA (*Jour. Soc. Chem. Ind., 20 (1901), No. 1, pp. 23-25*).—A discussion of the use of the hydrometer in determining the ammonia content of this substance.

The ash constituents of some Lakeland leaves, P. Q. KEEGAN (*Nature, 63 (1901), No. 1634, p. 396*).—The percentage of ash and the contents of silica and lime in the ash of the leaves of sycamore, wych elm, rowan, common and copper beech, birch,

and Scots pine at different dates are reported. The relation of the ash content and composition of the ash to the character of the soil on which the trees grew, is briefly discussed.

Potable water, woman's milk and cow's milk, food substances, and medicaments, H. LAJOUX (*L'Eau potable, le lait de femme et le lait de vache, matières alimentaires et médicamenteuses. Reims: F. Michaud, 1900, pp. 172, figs. 6*).—Gives methods of examination of water, milk, wines, butter, and other oils and fats, and for the determination of alkaloids, morphin, caffein, and theobromin, with analytical data obtained in the examination of such products, in the municipal laboratory of Reims.

A practical method for determining the hardness of water, G. MORPURGO (*Giorn. Farm. Chim., 50, pp. 440–445*).

The gravimetric determination of fat in milk by means of anhydrous sodium sulphate, O. LE COMTE (*Jour. Pharm. et Chim., 6. ser., 13 (1901), No. 2, pp. 58–60*).—By this method the water in the sample is absorbed by anhydrous sodium sulphate, 20 gm. sulphate to 10 cc. of milk. From the mixture the fat is extracted with ether and estimated in the usual manner.

The logwood test for alum, J. K. COLWELL and A. E. PARKES (*British Food Jour., 2 (1900), No. 24, pp. 346, 347*).—In testing baking powders for alum it was found that many made of tartaric acid and sodium bicarbonate gave the blue color with logwood extract. Upon testing the ingredients singly it was found that the reaction was produced with the tartaric acid, those samples containing small quantities of iron and lead responding to the test. Freshly prepared logwood extract made faintly alkaline with ammonium carbonate was sensitive to the presence of lead or iron in 1 part per 1,000,000, while a decided blue color was produced with 1 to 100,000 parts. A number of samples of commercial cream of tartar, pure potassium bisulphate, and calcium phosphate failed to give the reaction.

The blue color was also obtained with copper, zinc, and magnesium salts, although with the latter it was faint and rapidly faded.

Delicate tests for the determination of citric and tartaric acids, G. PARIS (*Ztschr. Untersuch Nahr. u. Genussmtl., 4 (1901), No. 4, pp. 160–162*).—A discussion of methods.

The estimation of gluten in flour, MARION and MANGET (*Ann. Chim. Analyt. et Appl., 5 (1900), pp. 249–252; abs. in Analyst, 26 (1901), No. 299, pp. 44, 45*). A modification of Fleurent's method (E. S. R., 11, p. 1075).

Note on the estimation of glycerol, J. LEWKOWITSCH (*Analyst, 26 (1901), No. 299, pp. 35, 36*).—An extended test was made of that method of determining glycerol in fermented liquors by which the liquor is treated with sulphuric acid and the glycerol estimated from the pure carbon obtained. The method was found to be wholly unreliable.

The treatment of rancid table oils and fats with soda solution, P. HUTH (*Ztschr. Angew. Chem., 1901, No. 7, p. 166*).—The author recommends mixing common salt with the soda solution in order to reduce saponification and to remove the saponified matter and clarify the fats and oils.

Investigations on the formation of nitric acid during combustion, M. BERTHELOT (*Ann. Chim. et Phys., 7. ser., 21 (1900), pp. 145–201*).—This is an account of studies of the formation of nitric acid during the combustion in a calorimeter under different pressures and with mixtures of gases of various forms of carbon, sulphur, iron and zinc, and hydrogen, with a discussion of the results as elucidating the principles involved.

Investigations on the method of Berthier for determining the heats of combustion of solid fuels, U. ANTONY and E. DINOLA (*Gaz. Chim. Ital., 30 (1900), II, pp. 218–224*).

Chemical and calorimetric investigations of fuel, H. LANGBEIN (*Ztschr. Angew. Chem., 1900, pp. 1227–1238, 1259–1272*).

The plant alkaloids, J. W. Brühl, E. Hjelt, and O. Aschan (*Die Pflanzen Alkaloide. Brunswick: Friedrich Vieweg, 1900, pp. 586*).

On a small laboratory furnace, A. Bruno (*Compt. Rend. Acad. Sci. Paris, 132 (1901), No. 5, pp. 276, 277, fig. 1*).—An attachment for a Bunsen burner, by means of which a crucible may be heated to very high temperature, is described.

Report of the chemical department of the State experiment station at Albano, Sweden, 1898-99, C. G. Eggertz (*Kgl. Landtbr. Akad. Handl. Tidskr., 39 (1900), No. 4, pp. 226-257*).—The subjects treated in the report are fertilizer experiments with Klagstorp clay soil and with Martebo marsh soil, potash experiments on sandy soils, and sugar-beet experiments conducted during 1898 and 1899.

BOTANY.

Alkali studies, V, B. C. Buffum and E. E. Slosson (*Wyoming Sta. Rpt. 1900, pp. 16, pls. 5*).—In continuation of these studies (E. S. R., 11, p. 1052), the authors report on the effect of alkali on the germination and growth of plants, the rate of absorption of salts from solution, and the evaporation of water from salt solutions and plants. It has been shown that the effect produced by salt solutions is inversely proportional to the osmotic pressure of the salt in solution. This indicates that the effect is a mechanical or physical one, and that the deleterious effects of various salts on plants depends on the osmotic pressure of the alkali salt in the soil rather than upon the physiological action of the different kinds of salts. This of course applies only to the neutral salts, and not to those which have a corrosive effect upon plant tissues. To further elucidate the above statement, experiments were carried on in germination and growth of plants in solutions of sulphates and chlorids of potassium and sodium having the same osmotic pressures. From the previous experiments the effect of sodium sulphate was determined and this was taken as an arbitrary base, the strengths of the other salts being ½, 1, and 2 per cent solutions. These percentages of sodium sulphate in solution represent atmospheric pressures of 2.03, 3.8, and 7.1 atmospheres. Wheat and alfalfa seed were germinated in sand which was given an amount of the different solutions equal to 15 per cent of moisture in the sand. From time to time the water lost by evaporation was replaced with distilled water. The germinations are shown in tabular form, from which it is seen that the effect of the different salts on both wheat and alfalfa was almost identical in each series of salt solutions. There was a regular decrease in the germinations of the seeds as the osmotic pressure increased and there was no apparent difference between the effect of sodium or potassium or between the sulphates and chlorids of the same or different salts. As in the experiments previously published, the effect of the salts in solution is to retard the time of germination. While the total percentage of seeds germinated was about the same for the salt solutions as those germinated with distilled water, the retardation amounted to as much as 5 or 6 days.

Pot experiments were conducted with wheat and alfalfa in which the solutions previously described were used, comparisons being made

with the same plants grown in a normal nutritive solution. All the salts in weaker solutions produced a stimulating effect on the growth of both wheat and alfalfa. The decrease from the effect was quite regular with the increase in osmotic pressure with all the salts except potassium chlorid, which retarded growth much less than the other salts. With osmotic pressure represented by 3.8 atmospheres, potassium chlorid forced alfalfa into bloom earlier than the other pots, and its fertilizing effect was very marked except where the strongest solution was used with alfalfa. With this solution the retarding effect was as great or greater than that of any of the salts of the same concentration.

In order to determine how far the salts were absorbed by the plants, they were analyzed for chlorids and sulphates, and it was found that in case of both potassium and sodium sulphates the more concentrated the solution the greater the amount of salt so taken up by the plant; but in the case of the chlorids the normal amount found in the plant was not increased, but in some cases was actually diminished, by increase in the concentration of the solution.

The evaporation of water from the salt solutions and the plants growing in them was measured and the results are given in a table, which shows the amount of water added to each pot to take the place of that lost by evaporation and to bring it back to the initial weight. The increase in evaporation during June was due to the increased amount of water drawn off by the plants as they rapidly increased in size. Wheat produced more weight of plant in the nutritive solution alone than in any of the salt solutions, and in every case less water was lost by evaporation and transpiration from the salt solutions. On the other hand, alfalfa produced more weight of plant in the weaker salt solutions and more water was lost in these solutions than from the nutritive solution alone. In general, there was greater evaporation from the check pots than from those containing salts.

The germination and growth of peas in solutions of fatty acid salts to the exclusion of mineral salts, O. Lövison (*Bot. Centbl.*, *83* (*1900*), *Nos. 1, pp. 1–12; 2, pp. 33–43; 3, pp. 65–75; 4, pp. 97–106; 5, pp. 129–138; 6, pp. 185–195; 7–8, pp. 209–224, figs. 4*).—Normal solutions of formic, acetic, and propionic acid were found to penetrate the cells of the seed without causing their immediate destruction. The germination of peas was retarded when subjected to solutions of 77.5 per cent normal formic acid, 66.6 normal acetic acid, or 10 per cent normal propionic acid, the effect of the different solutions being in proportion to the molecular weight of the acids. The solutions were found to retard the growth of plants in about the same way that their germination was affected. The average time that plants survived after

being placed in water cultures of normal solutions was 52 days for formic, 28 days for acetic, and 17 days for propionic acid. The injurious influence of these acids upon the plants was mostly shown by the effect upon the roots. The protoplasm of the cells of the roots becomes granular, while the younger cells are killed outright. It was thought possible to accustom plants to acids by beginning with dilute solutions and increasing the concentration, so that plants may not be injured by full normal strengths. It was found that the plants and vessels require frequent cleansing of fungi and bacteria, as these solutions are good nutrient media for cryptogamic plant growth. A concentration of solutions that will prevent the functions of the cotyledons and thereby reduce the plant to a state of starvation was necessary as preliminary to the nutrition of plants. Pea seedlings were kept for 80 days or more in a normal formic-acid solution. The plants grew and developed normally, although somewhat reduced in size.

The author believes that his experiments show the fallacy of the claim that phosphates, sulphates, and alkalies are necessary for plant nutrition.

The toxic action of acids and their sodium salts on lupines, R. H. TRUE (*Amer. Jour. Sci., 4. ser., 9 (1900), No. 51, pp. 183–192*). In previous papers dealing with the toxic action of dissolved salts and their electrolytic dissociation, evidence was presented on the ionization of the molecule on the poisonous properties exerted by these substances on the radicles of *Lupinus albus*. The toxicity of the acids was found to be largely due to the action of hydrogen ions formed in the aqueous solution.

In the present paper the effect of certain series of acids and their salts on the lupine is given, from which it appears that in the inorganic acids there is very free ionization. Practically complete dissociation exists at their death limits for lupines. The sodium salts of these acids, as far as tested, agree in having a low toxic value. As a rule, the organic compounds offer somewhat greater difficulties, the ionization of the molecule being seldom complete at the death limit.

The fatty-acid series was examined, from which it was found that formic acid was distinctly the most toxic member of the group. The sodium salts showed little difference in their action, the formate, propionate, and butyrate giving identical death limits. The acetate was found to be very weak in its poisonous action.

The aromatic series was investigated, and in general these acids showed a considerable variation in their toxic values due to their chemical structure. In general, the anions of organic acids were found to possess relatively slight toxic properties, sometimes so slight as to be neglected, as in the case of acetic and hippuric acids. The sodium ions are but weakly toxic and the anions sometimes relatively ineffective.

The relation of seedlings of gymnosperms to light and darkness, A. BERGERSTEIN (*Ber. Deut. Bot. Gesell., 18 (1900), No. 4, pp. 168–184*). Detailed reports are given of investigations of more than 100 species of gymnospermous plants to ascertain the effect of light and darkness upon their seedlings. The general conclusions of the author show that the seedlings of gymnosperms, with the exception of *Ginkgo biloba* and *Ephedra* spp., become green even in the absence of light. The rapidity with which the green coloration is taken on varies with the temperature, the best temperature being from 15 to 25° C. The experiments with Cycas and Zamia showed that these plants even in the most favorable temperatures were unable to develop chlorophyll in their seedlings in the complete absence of light. The author believes that this generalization will apply to the Cycadaceæ. Among many of the conifers, especially the Cupressineæ, chlorophyll is formed under favorable temperature conditions in the absence of light, and with the exception of *Larix* spp., it is formed not only in the cotyledons but also in the hypocotyl. Experiments with Araucaria showed that this plant was able to produce chlorophyll in branches developed while the plant was kept in darkness for several weeks, the formation of chlorophyll not being confined to the cotyledonary leaves, as is the case of the other conifers. In many of the Coniferæ, especially in species of Abies and Cedrus, the embryo contains chlorophyll even in the dormant seeds. In others the seedlings begin to turn green before the seed coat is broken or shortly after the emergence of the radical. Seedlings of conifers grown in the dark have shorter roots and cotyledons, but larger and thicker hypocotyls than similar plants grown in the light. The cells of the hypocotyl of plants grown in darkness are absolutely longer and their diameter less than those grown in the light.

Observations on latex and its functions, J. PARKIN (*Ann. Bot., 14 (1900), No. 54, pp. 193–214, pl. 1*).—Notes are given on a number of observations on the latex observed in rubber plants, and suggestions as to its origin and functions. These observations were made during an economic study of rubber and caoutchouc plants in Ceylon. The coagulation of the latex is said to be brought about by the proteids contained in it passing from a soluble to an insoluble form. The conditions for this coagulation will depend upon the kind of proteid present. If the proteid is a globulin or an albumin it is collected by heating; if an albuminate, by neutralization. The investigations of a number of different latex-bearing plants showed that in the case of *Hevea brasiliensis* the proteid is an albuminate. In Castilloa the proteid belongs probably to the class of albumoses, and in *Hura crepitans* the proteid seems to be largely globulin.

Several specimens of the latex which were pure white when first issuing from the wound rapidly darkened on exposure to the air, due

to the presence of an oxydizing ferment or oxydase. The behavior of different kinds of latex in reference to oxydases is mentioned. As a rule oxydases are more frequently found in immature parts of plants.

Investigations made of the carbohydrates of latex show the presence of sugar and starch. The sugar is believed to come from the surrounding tissues and not originally from the laticiferous tubes. Starch rods were found abundantly in the different parts of the plants, and, from experiments conducted with dead and withered leaves, it is believed that the starch present in the latex has nothing directly to do with carbon assimilation. Different characteristics and properties are noted in the latex of young and old organs of the same plant and of different kinds of plants. The effect of previous wounding on the flow of latex was investigated, and it was found that by repeated woundings the amount collected could be increased as much as seven times. This observation was made with Hevea trees, and is of great practical importance from an economic standpoint. In considering the origin and function of latex, the author believes that its principal function is in all probability as a reserve for water. The hypothesis that latex is present in plants for protective purposes is, in the author's opinion, hardly warranted, as rubber and other plants are subject to fungus diseases and insect attacks to as great extent as many other plants not provided with laticiferous tissues.

The metabolism of proteids in plants, E. SCHULZE (*Ztschr. Physiol. Chem., 30 (1900), No. 3-5, pp. 241-312; Ber. Deut. Bot. Gesell., 18 (1900), No. 2, pp. 36-42*). A detailed report is given of a series of experiments upon the metabolism of proteids by germinating seeds of *Pisum sativum*, *Vicia sativa*, *Lupinus luteus*, and *L. albus*, a preliminary account of the investigations having been given in the second publication noted above. In seeds germinated in darkness asparagin, leucin, tyrosin, arginin, histidin, and lysin were found. The amounts of these different substances varied with the seedlings, and with the same seedlings at different times. An increase in asparagin was usually accompanied by a decrease in the others, especially in the content of leucin, tyrosin, and arginin. The proteid compounds which were found to accumulate in the etiolated seedlings varied according to the different kinds of seeds, arginin acumulating in *L. luteus*, while at other times in old etiolated seedlings leucin was present in greater or less degree.

The previous theory of the author that the decomposition of proteids in germinating plants results in the formation of certain amido acid compounds as well as hexose bases through the action of acid or trypsin within the organism is said to be confirmed. The varying amounts of these compounds are attributed to the fact of their being secondary products. The older hypothesis that the proteids in germinating seeds split up into asparagin and carbohydrates the author claims is untenable.

The artificial inoculation of beans with pea tubercle bacteria, F. NOBBE and L. HILTNER (*Centbl. Bakt. u. Par., 2. Abt., 6 (1900), No. 14, pp. 449–457, pl. 1*). Reciprocal inoculations were made upon beans and peas with bacteria from the tubercles of each, and with bean tubercle bacteria from tubercles grown upon peas, and *vice versa*, the object being to ascertain the effect of the adaptation of the organisms to plants of a different genus than that from which they were originally secured. It was found that if either plant were inoculated with germs from the tubercles of the other some tubercles would be formed, but the organisms seemed to be without the power of nitrogen assimilation. If the inoculation was continued a second season, or through a second or third series of cultures, the bacteria became nearly as efficient as those from the roots of the same genus. To the organisms resulting from such adaptations the authors have given the name "crossed" or "crossbred bacteria." If inoculations with these crossbred bacteria be made upon their original host they will be found to have nearly lost their ability of nitrogen assimilation on the roots of that plant, showing little if any increased nitrogen content over noninoculated plants. The effect of the various inoculation materials as shown by the experiments with peas is given in the following table:

Average results of inoculating peas grown in pots.

Inoculation material.	Height of plants.	Number of leaves per plant.	Pods per pot.	Seeds per pot.	Dry matter in plant.	Nitrogen in plant.
	Mm.				*Gm.*	*Mg.*
Bean tubercle bacteria	888	18	11.5	8.0	5.29	76.5
Pea tubercle bacteria	1,144	19	28.0	108.5	24.03	743.0
Crossbred bacteria	1,146	18	26.0	59.0	16.78	366.0
Check, uninoculated	891	17	7.0	9.0	5.33	89.0

If the dry matter and nitrogen content of beans and peas inoculated with their own root tubercle bacteria be each represented by 100, the effect of crossbred bacteria upon beans would be represented by 80.74 for the dry matter and 74.8 for the nitrogen content. Upon the peas crossbred bacteria produced 69.83 per cent of dry matter and 49.26 per cent of the quantity of the nitrogen stored up in plants inoculated with pure pea tubercle bacteria. The possibility of the transfer of tubercle bacteria from the roots of one plant to those of a different genus is affirmed.

Studies on American grasses, F. LAMSON-SCRIBNER and E. D. MERRILL (*U. S. Dept. Agr., Division of Agrostology Bul. 24, pp. 55, figs. 23*).—Notes are given by the authors on some recent collections of Mexican grasses, of which 227 species and varieties are enumerated, 11 species and 1 variety being new. Notes are also given on some species of Panicum, in which Lamarck's types of *P. nitidum*, *P. scoparium*, and *P. pubescens* are figured and described. Miscellaneous notes and descriptions of new species are also given by F. Lamson-Scribner and C. R. Ball of a number of grasses occurring in the Gulf States. Five new species of Elymus are figured and described.

The order of formation of the elements of the central cylinder in roots and stems, G. BONNIER (*Compt. Rend. Acad. Sci. Paris, 131 (1900), No. 20, pp. 781–789, figs. 6*).—The general structure of the central cylinder and that of the stem and root and the order of the development of the tissues are the same except in the different position of the ligneous poles.

Some ways of seed distribution, F. H. HILLMAN (*Nevada Sta. Bul. 48, Educational Ser. III, pp. 10, figs. 15*).—The author figures and popularly describes some of the methods by which seeds of weeds and other plants are distributed.

Exchange seed list No. 5, W. A. SETCHELL and J. B. DAVY (*California Sta., 1900, Dec., pp. 11*).—A list is given of seeds of economic plants which are offered for exchange and a list given of seeds which are desired by the department of botany at the station. The seeds enumerated in this list are for exchange only.

New sugar-yielding plant in French Central Africa, A. CHEVALIER (*Sucr. Indig. et Coloniale, 57 (1901), No. 3, pp. 75–81*).—The plant discussed in this article is Bourgou (*Panicum burgu*).

Influence of atmospheric humidity on vegetation, S. MOTTET (*Rev. Hort., 73 (1901), No. 2, pp. 38, 39*).—The author believes the rôle of atmospheric humidity in plant growth is greater than is usually supposed. Observations on the growth of a number of different plants as influenced by atmospheric humidity are presented.

Reproduction in relation to problems in hybridization, O. AMES (*Amer. Gard., 22 (1901), No. 322, p. 130*).—A controversial article.

Reserve carbohydrates of Thallophytes, G. CLAUTRIAU (*Misc. Biol. déd au A. Giard; abs. in Jour. Roy. Micros. Soc. [London], 1900, No. 6, p. 698*).—According to the author, the most abundant carbohydrate in the Myxomycetes is glycogen, which usually occurs in the plasmodia in a half-dissolved condition. The spores contain only oily substances. The Peridinieæ contain drops of oil and pure starch, and their membranes give the reaction of cellulose. In the Cyanophyceæ a reaction with iodin is given, resembling that of glycogen, and the presence of glycogen in bacteria is believed probable. In the green algæ starch is abundant, and in many of the red algæ a carbohydrate closely resembling starch is present. Fungi are said to contain an abundance of glycogen and oily substances, besides various forms of sugar, glucose, levulose, trehalose, and mannite.

The influence of chemical agents on the growth of algæ and fungi, N. ONO (*Jour. Col. Sci. Imp. Univ. Tokyo, 13 (1900), pp. 141–186, pl. 1; abs. in Jour. Roy. Micros. Soc. [London], 1900, No. 6, pp. 698, 699*).—A large number of experiments are reported upon, in which the effect of different chemical salts upon algæ and fungi is shown. Extremely dilute solutions of some poisonous salts were found to promote the growth of the lower algæ. Among these were zinc sulphate, iron sulphate, copper sulphate, and iron arsenite. These substances favored the multiplication of the organisms rather than increase in the size of the individual. The fungi were found to be more sensitive to small quantities of mineral salts than the algæ, and the formation of spores was especially checked by these substances. The optimum concentration of mercurial chlorid for fungi was found to be about 0.0013, and of copper sulphate about 0.012.

The meaning of mycorrhiza, E. STAHL (*Jahrb. Wiss. Bot. [Pringsheim], 34 (1900), pp. 539–668, figs. 2; abs. in Jour. Roy. Micros. Soc. [London], 1900, No. 6, p. 707*).—The author enumerates all the plants in which ectotropic and endotropic mycorrhiza are known to exist. At present, mycorrhiza are unknown in the families Cruciferæ, Cyperaceæ, and Polypodiaceæ; but the author considers it probable that the greater number of the higher plants are capable, under certain circumstances, of entering into symbiosis with fungi. The explanation of the occurrence in the same forest of plants which do and others which do not obtain their nourishment in this way is found in the difference in their facility of absorbing mineral food material. Plants

with a rapid transpiration current can dispense with the formation of mycorrhiza, while those with weak transpiration can obtain a sufficient supply only by the assistance of the symbiotic fungus.

Notes on the cytology of Gastromycetes, R. MAIRE (*Compt. Rend. Acad. Sci. Paris, 131 (1900), No. 26, pp. 1247, 1248*).—Cytological notes are given upon the study of a number of species of Lycoperdon, Nidularia, Geaster, and Cyathus.

Fungi of Florida, H. H. HUME (*Florida Sta. Rpt. 1899 and 1900, pp. 38–44, fig. 1.*)—A list is given of fungi collected by the author and others, in which the distribution of the species is indicated and several new species described.

Cryptogams of Wyoming, A. NELSON (*Wyoming Sta. Rpt. 1900, pp. 38*).—A list is given with descriptive notes on a number of species of cryptogams that have been collected by the author and others in the State of Wyoming. This list is published as supplemental to the report on the flora of Wyoming (E. S. R., 8, p. 956).

METEOROLOGY—CLIMATOLOGY.

Monthly Weather Review (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 28 (1900), Nos. 10, pp. 425–476, figs. 17, charts 10; 11, pp. 477–526, pls. 2, figs. 4, charts 10; 12, pp. 527–583, pl. 1, fig. 1, charts 10*).—In addition to the usual reports on forecasts, warnings, weather and crop conditions, meteorological tables and charts for the months of October, November, and December, 1900, these numbers contain the following articles and notes.

No. 10, special contributions on Lightning from a cloudless sky, by B. S. Pague; Property loss by lightning in the United States, 1899, by A. J. Henry; Cumulus clouds at the Bayonne, N. J., fire, by J. H. Eadie; Drift ice and the theory of ocean currents, by R. A. Daly; The dynamic principle of the circulatory movements in the atmosphere (illus.), by V. Bjerknes; and The Porto Rican hurricane of 1899, by C. O. Paullin; and notes by the editor on the Weather Bureau at the Paris Exposition, the proceedings of the Permanent International Meteorological Committee, oscillations of lake level, correction, Weather Bureau men as instructors in meteorology, training needed to become investigators, climate and flora, heaviest rainfall at La Crosse, Wis., meteorological cablegrams, psychrometric tables, observations during the solar eclipse, pogonip, and the long record of Mr. S. P. Davidson.

No. 11, special contributions on Rainfall from convectional currents (illus.), by H. H. Kimball; Rainfall on the Island of St. Kitts, W. I. (illus.), by W. H. Alexander; Notes on local whirlwinds in New Brunswick, by S. W. Kain; Lightning from a cloudless sky, by C. E. Ashcraft, jr.; Climate of Spokane, Wash., by C. Stewart; Fog studies on Mount Tamalpais, by A. G. McAdie; The water supply for the season of 1900 as depending on snowfall; and Tornadoes in Tennessee, Mississippi, and Arkansas (illus.), by S. C. Emery.

No. 12, special contributions on The circulatory movements in the atmosphere, by V. Bjerknes; Line integrals in the atmosphere (illus.), by F. H. Bigelow; The people of Mars, by C. F. Talman; Prof. N. H. Yerby, by F. P. Chaffee; and Records by the kite corps at Bayonne, N. J., by W. H. Mitchell; and notes by the editor on weather forecasts in Mexico, meteorology in Costa Rica, micro-photographs of snow crystals, bombarding hail clouds, meteorology as a college course, mars and the earth, oscillations of the lakes and the climate in arid regions, erosion due to heavy rains and steep grades, mirage over Lake Michigan, meteorology at the Paris Congress of 1900, meteorology and geodesy, periodicity in meteorology, mathematics in meteorology, a memorable storm of sleet and snow, hurricanes at Charleston, S. C., high

tides and approaching storms, cumulus clouds above fires, lightning without thunder, reduction of the barometer to standard gravity, hurricanes in Jamaica, W. I., commercial importance of storm and weather forecasts, the evolution of the thermometer, a barometer needed in balloon voyages, lectures and instruction, the use of the Monthly Weather Review by teachers, aerial voyages by balloons and kites, transatlantic weather, correlation of weather in distant localities, new meteorological stations needed, lightning from cloudless skies, lake commerce and insurance, the weather and the newspapers, the first National Meteorological Congress of Mexico, chronological cycles, relations between summer and winter temperatures, Arctic and Antarctic meteorological observers, typhoon of November 10 in Hongkong, equinoctial storms, and Weather Bureau publications for school use.

Meteorological observations, C. S. PHELPS (*Connecticut Storrs Sta. Rpt. 1899, pp. 219-221*).—This is a record of observations on temperature, pressure, humidity, precipitation, cloudiness, and wind movement during each month of 1899 at Storrs, and on rainfall during the 6 months ended October 31, 1899, at 21 places in Connecticut. The mean temperature for the year at Storrs was 47° F.; mean pressure, 30.07 in.; total precipitation, 38.31 in.; number of cloudy days, 102. The average rainfall for the State during the 6 months ended October 31 was 19.34 in.

"The total precipitation for the year (38.31 in.) was 6.8 in. below the average at Storrs for the past 11 years, and about 10 in. below the general average for Connecticut. . . . The last killing frost in the spring occurred May 4. The temperature for June was somewhat above the normal, but for the balance of the summer it was about the average. The growing season was shorter than usual, light frosts occurring September 7 and 14, and quite severe frosts September 15 and 16."

Meteorological report for 1899, C. B. RIDGAWAY (*Wyoming Sta. Rpt. 1900, pp. 23*).—A brief statement of the equipment of the station for meteorological observations, with tables giving daily observations on temperature, relative humidity and dewpoint, atmospheric pressure, and wind movement at Laramie, Wyo., for each month of 1899, as well as a monthly summary of precipitation and evaporation for 1891–1899. The summary for 1899 is as follows:

Temperature (degrees F.).—Highest, 87, June 29 and July 25; lowest, −40, February 12; mean for the year, 38.8; highest daily range, 63, February 12; lowest daily range, 5, October 9; mean daily range for the year, 24.4. *Humidity.*—Mean relative for the year, 57.1; lowest relative, 6, September 7. *Dewpoint.*—Highest, 60°, September 5; lowest, −38°, February 6; mean for the year, 23.9°. *Atmospheric pressure* (inches).—Highest, 23.502, September 25; lowest, 22.442, January 31; mean for the year, 23.079. *Precipitation* (inches).—Highest monthly, 2.01, in July; lowest monthly, 0.07, in November; highest during any single storm, 0.91, July 13; total for 1899, 11.84; mean for 9 years, 10.15. *Evaporation.*—Total for 6 months (April 22 to October 15), 20.58 in.; greatest monthly, 4.42 in., in May. *Wind.*—Prevailing direction, southwest; greatest velocity, 58 miles per hour; total number of miles traveled during the year, 117,284; greatest number of miles traveled in 1 month, 12,787, in January; lowest number of miles traveled in 1 month, 7,245, in November; average number of miles for each month, 9,773.6; greatest number of miles in 1 day, 744, May 21; least number of miles in 1 day, 97, December 13. *Weather.*—Number of clear days, 178; number of fair days, 142; number of cloudy days, 45; number of days on which there was a precipitation of 0.01 or more, 75.

Rainfall in the west and east of England in relation to altitude above sea level, W. MARRIOTT (*Quart. Jour. Roy. Met. Soc. [London], 26 (1900), No. 116, pp. 273–280, figs. 2*). The mean monthly and annual rainfall at the English and Welsh stations are grouped according to altitude, all stations being considered as "western" which drain to the west and all "eastern" which drain to the east. There is shown to be a general increase in rainfall as the altitude increases up to 1,000 ft. There is nearly a fourth more rainfall in the west than in the east, but it is much more variable. The greatest rainfall occurs in the west in November, in the east generally in October, although there is a great rise of rainfall both east and west from June to July. April, May, and June are very dry in the west. The greater rainfall of the western part of the British Isles is explained by the fact that the prevailing winds are southwesterly. The author considers the assumption of an increase of 3 per cent for each 100 ft. to be incorrect. It is shown by the data here reported to vary from 1 to 38 per cent, depending upon exposure, position, and surroundings, as well as upon altitude.

The climate of Allegany County, O. L. FASSIG (*Maryland Geological Survey—Allegany County. Baltimore: Johns Hopkins Press, 1900, pp. 217–231, figs. 5*).—Tables and diagrams are given which show the results of temperature observations at Cumberland for 37 years (1859–1895), the mean monthly and annual temperatures for 9 stations in Allegany County at which observations have been made during a period of one year or more, the monthly and annual precipitation at Cumberland during the period from 1871–1895, and the general climatic features of the county are briefly discussed. The highest temperature recorded is 109° F. at Boettcherville July 3, 1898, the lowest —22°, at Frostburg February 13, 1899. The mean annual temperature at Cumberland, based on 37 years' observations, is 51.5°. The mean annual rainfall at the same place, based on 27 years' observations, is 32.86 in. The stations for meteorological observations in the county are described.

Meteorological tables, T. S. OUTRAM (*Minnesota Sta. Rpt. 1900, pp. 731–739*).—Tables prepared by the director of the Minneapolis office of the Weather Bureau are given, showing the monthly and yearly averages and departures from normal of temperature and precipitation, based on observations at some 64 places in Minnesota during the year ended June 30, 1900.

Meteorological observations, H. L. PRICE (*Virginia Sta. Rpt. 1900, p. 10*).—Tables are given which show monthly averages of observations at Blacksburg, Va., on temperature, precipitation, direction of wind, and cloudiness, for the year ended June 30, 1900; and monthly means of temperature and precipitation during 8 years (1893–1900). The mean temperature for the year ended June 30, 1900, was 82.71° F., the precipitation 35.36 in.

Moore's meteorological almanac and weather guide, 1901, W. L. MOORE (*Chicago: Rand, McNally & Co., 1900, pp. 128, figs. 21, charts 32*).—The object of this treatise is stated to be "to present in concise form such weather data and facts relative to meteorological phenomena as will be at once interesting and profitable to the farmer, the horticulturist, the shipper of perishable produce or manufactures, the merchant, the mariner, the teacher, the student, and the seeker after health or pleasure. Effort will be made to correct many popular but erroneous impressions relative to climate and weather." It contains in addition to the usual data given in almanacs,

statements of the highest and lowest temperatures recorded at different places in the United States during each month of the year, and articles relating to the history of meteorology; some wonderful phenomena of the air, the construction and the use of the weather map (with charts), the uses and the errors of storm warnings, tornadoes, long-range forecasts, the Galveston hurricane of 1900 and the blizzard of 1899, great floods of the United States, protection from frost, loss of life and property by lightning, lightning strokes, temperatures injurious to food products, Weather Bureau kites, work of voluntary observers and crop correspondents, magnitude of the United States daily atmospheric survey, and climate for the health seeker, the tourist, and the investor, including information regarding the climate of Cuba, Porto Rico, Hawaiian Islands, and the Philippine Islands; the hottest and coldest places in the world, the weather and sun spots, and change of climate.

The weather and agriculture, R. Börnstein (*Deut. Landw. Presse, 28* (*1901*), *Nos. 5, pp. 31, 32; 7, p. 45*).—A general discussion of this subject.

The weather v. the newspapers, H. M. Watts (*Pop. Sci. Mo., 58* (*1901*), *No. 4, pp. 381–392, figs. 4*).—The relation of the newspapers to the dissemination of information regarding the weather is briefly discussed, the claim being made that "for the most part the average newspaper fails in its duty to the public, so far as the weather is concerned, in the four following particulars:

"(1) By reason of a misapprehension and misrepresentation of the simplest fundamental facts of atmospheric circulation and weather movement, effects being treated as causes, etc.

"(2) By reason of a constant confusion of terminology and a generally slipshod use of weather terms and facts.

"(3) By reason of a persistent refusal to recognize much, if any, difference between the scientist and the charlatan, between the expert and the quack; and, in fact, by a disposition—marked in some quarters—to give undue prominence to bogus weather prophets and wonder-mongers, at the expense of the equipped and reputable students of the subject.

"(4) By reason of a hypercritical but uninformed attitude toward the daily forecasts of the United States Weather Bureau, by which the work of the Bureau is hampered and its value to the public materially reduced."

Cannonading as a protection against hail, J. Dufour (*Chron. Agr. Canton Vaud, 14* (*1901*), *Nos. 3, pp. 61–67, figs. 2; 4, pp. 95–107, figs. 5*).—A brief general discussion.

The mode of action of cannon used in combating hail, G. Gastine and V. Vermorel (*Grêle, 2* (*1901*), *No. 3, pp. 12–18*).

Corrections for mean daily temperature calculated from a limited number of observations, M. Moreno y Anda (*Mem. y Rev. Soc. Cient. "Antonio Alzate," 15* (*1900–1901*), *No. 1–2, pp. 5–11*).

Anemometry, C. F. Marvin (*U. S. Dept. Agr., Weather Bureau Doc. 233, pp. 67, pl. 1, figs. 28*).—This is a second edition, revised, of "a circular of general information respecting the theory and operation of instruments for indicating, measuring, and automatically recording wind movement and direction, with instructions for the erection and care of such instruments of the Weather Bureau pattern."

An electric anemometer for transmitting observations to a distance, E. Legrand (*Compt. Rend. Acad. Sci. Paris, 132* (*1901*), *No. 6, p. 323*).

New wind-recording apparatus (*Sci. Amer. Sup., 51* (*1901*), *No. 1308, p. 20963*).—A brief description of an apparatus in use at the Agricultural College of Berlin which is capable of recording eight directions of the wind.

Meteorological instruments, H. Hartl (*Sci. Amer. Sup., 51* (*1901*), *Nos. 1308, pp. 20962, 20963; 1309, pp. 20978–20980, figs. 20*).—Descriptions are given of various forms of thermometers and thermographs and barometers, barographs, psychrometers, etc., with brief explanations of their use.

WATER—SOILS.

River and artesian waters, R. H. FORBES (*Arizona Sta. Rpt. 1900, pp. 180-184*). The results are reported of determinations of silt, alkali salts, and nitrogen in representative samples from a flow of one week, both high and low water, of the Colorado at Yuma, the Gila at Florence, and the Salt River at Mesa City; also of a canal taking water from the lower Gila, as well as of alkali salts in 9 samples of water from artesian wells on the eastern slope of Graham Mountain above Safford, Thatcher, and Pima and in the San Pedro Valley south of Benson. The analyses reported show that the 3 principal rivers of the Territory are "of quite variable character for irrigating purposes, containing, in the instances mentioned, from 50 to 200 parts of soluble salts in 100,000, in round numbers."

"The quantity of soluble salts is influenced by the stage of water and by seepage from irrigated districts. The nature of these salts is influenced by the same causes. The Colorado River is less saline the year around than either the Salt or the Gila. In summer, when its waters rise under the influence of the melting snows in Colorado and Utah, the total soluble solids were observed to average as low as 25 parts in 100,000 for months at a time.

"Flood waters in all cases not only carry less salts but more silt, including nitrogenous fertilizing materials. Barring the inconvenience of excessively muddy water, therefore, flood waters are in every way preferable for irrigating purposes.

"The average amount of silts in the Salt River supply from August 1, 1899, to August 4, 1900, was by weight 0.1 per cent of the water; by volume, 0.3 per cent. This amount of silt is unquestionably less than the average on account of the unusually low water prevailing during most of the time of sampling. The Salt River, however, is undoubtedly far less silty than the Gila, and this element of doubt in connection with the life of reservoirs correspondingly less. . . .

"The average total nitrogen in the Salt River supply for one year was found to be 3.25 parts in 1,000,000 of water, including that which was contained in the silt. Of this amount 1.04 parts per million existed in the form of nitrates."

The analyses of the artesian waters show that while the total soluble salts are not excessive, sodium carbonate is uniformly present, varying in different cases from 3.4 to 19.6 parts per hundred thousand. An analysis of an alkali crust from the region in which some of the artesian wells are located shows that a considerable amount of calcium sulphate is present. "Should the soils of this region prove to contain calcium sulphate generally, the alkalinity of the artesian wells will, at least for a time, be rendered harmless thereby."

A preliminary report on the artesian basins of Wyoming, W. C. KNIGHT (*Wyoming Sta. Bul. 45, pp. 107-251, pls. 26, map 1*).—This is a preliminary treatise on the geology and artesian basins of Wyoming, based upon field notes collected during the past four years, accompanied by a map embodying "all that is known of the geology of Wyoming up to date," the object of the publication being to explain the essential features of the artesian basins of the State, so that artesian wells may

be located. It is stated that nearly all available water of the streams of the State has already been appropriated, so that an increased supply for the future can be secured only from underground sources. "Artesian basins are numerous in Wyoming, and some of them are very large and especially well located." Twelve such basins are described in this bulletin, namely, the Big Horn, the Shoshone, Powder River, Green River, Sweetwater Valley, Laramie, the Shirley, Cheyenne, the Carbon, the Uinta, the Gros Ventre, and the Teton. No systematic attempts to develop the water resources of these basins have been made, but, "judging from the source of the water in many of the Wyoming basins, the artesian wells in this State should equal any that have been drilled in South Dakota."

Lysimeter experiments in 1899, J. HANAMANN (*Ztschr. Landw. Versuchsw. Oesterr., 4 (1901), pp. 34–39; abs. in Chem. Centbl., 1901, I, No. 5, p. 270*).—The drainage water obtained during 1899 contained a smaller percentage of salts than that of the previous year (E. S. R., 10, p. 930), due to the fact that a compact alluvial soil was used and percolation was slower. The greatest loss of nitrogen in the drainage occurred in case of bare soil, the order of losses in other cases being (1) soil bearing young red clover, (2) that under flax and beans, and (3) that under summer grain. Lime was the constituent most easily removed from the soil. The losses of potash and soda were practically the same. Chlorin and sulphuric acid were removed in considerable quantities, especially in bare soil. Phosphoric acid could scarcely be detected in the drainage water of soils bearing crops. In bare soils traces were found.

The lime compounds of cultivated soils and the determination of assimilable lime in soils, D. MEYER (*Landw. Jahrb., 29 (1900), No. 6, pp. 913–1000; Fühling's Landw. Ztg., 49 (1900), Nos. 22, pp. 842–847; 23, pp. 865–871; 24, pp. 904–910; abs. in Deut. Landw. Presse, 28 (1901), No. 7, pp. 46–48, figs. 3*).—Chemical and physical analyses and pot tests of 26 samples of two classes of soils—light and heavy—are reported in detail. The lime content of the soils examined varied from 0.092 to 1.271 per cent. The average for light soils was 0.333 per cent; for heavy soils, 0.694. The average percentage of carbon dioxid was 0.052 per cent in light soils and 0.098 in heavy soils, the average for 22 of the samples being 0.045. In case of the light soils 25.7 per cent of the lime was in the form of carbonate; in case of heavy soils, 19.1 per cent. While a high percentage of carbon dioxid usually indicated a high percentage of lime in the soil, a small percentage of carbon dioxid did not always indicate a low lime content. Calcium humate was found in appreciable amounts only in a few cases. The solubility of the lime in 2 per cent hydrochloric acid varied in case of the light soils from 38.5 to 92 per cent, averaging 68.9 per cent; in case of heavy soils, from 66.6 to 90.2 per cent, averaging 78.4 per

cent. Of the total amount of lime present in the soils 24.1 per cent was found in particles from 0.2 to 6 mm. in diameter, 21.6 per cent in the fine sand, and 54.3 per cent in the dust (silt). In certain of the soils, especially the heavy soils, a considerable proportion of the lime was apparently in the form of silicate. As regards the influence of the lime on the growth of plants as determined in pot experiments, the various lime compounds tested stood in the following order, beginning with the highest: (1) Carbonate and caustic lime, dolomite, and basalt; (2) Thomas slag, scolecite, anorthite, diabase, and nephelinite; (3) apophyllite; (4) phosphorite; (5) dicalcium phosphate and apatite; (6) fluorspar, and (7) monocalcium phosphate. Gypsum gave negative results. The highest yields were obtained when a mixture of calcium carbonate, magnesium carbonate, burnt lime, and burnt magnesia was applied. Of the phosphates, Thomas slag gave the best results, dicalcium and monocalcium phosphate the poorest. The poor results obtained with the superphosphate are attributed to the fact that it failed to neutralize the acid condition of the soil. Of the silicates, the zeolites gave specially good results. The results with gypsum are in direct contradiction to those usually obtained in practice. Even in case of leguminous plants the gypsum was without beneficial effect. The amounts of lime dissolved by concentrated and dilute hydrochloric acid bore no relation to the yield of crop or to the amount of lime assimilated. Neither did the carbon dioxid content furnish a reliable index of the amount of lime taken up by the plant, since a low percentage of carbon dioxid did not always indicate a deficiency of available lime. There was no appreciable difference in the lime content of the grain of rye grown on limed and on unlimed soils. The percentage of lime in the straw was increased by liming only when there was no increased yield. The active forms of lime in the soil are undoubtedly carbonate, sulphate, and easily decomposable silicates. The proportions of these which are most available for plant growth may be determined by treatment with neutral solutions of ammonium chlorid or ammonium nitrate. Digestion for 3 hours with 10 per cent ammonium chlorid solution at 100° C. on a water bath is considered a satisfactory means of accomplishing this. This method has decided advantages over the old method of digestion in 10 per cent hydrochloric acid, since the lime can be directly determined without separation of silica. Moreover, the results obtained show a closer agreement with crop results and with the amount of lime taken up by plants. A lime content of 0.25 per cent by this method is considered normal. Less than 0.2 per cent indicates a deficiency of lime in the soil.

The distribution of alkali in the soil of the experiment farm, E. E. SLOSSON (*Wyoming Sta. Rpt. 1900, pp. 4*).—Determinations of the amount of alkali in the soil at depths of from 3 in. to 3 ft. on

different parts of the experiment farm are reported. The method followed in making these determinations was as follows:

"One hundred grams of soil was put into a glass-stoppered bottle with 200 cc. of distilled water and left for several days with occasional shaking. When it is settled a convenient quantity is drawn off with a pipette and without filtering evaporated to dryness and heated at a temperature above 250° C. for 2 or 3 hours. By this heating the gypsum becomes dehydrated and almost insoluble, so all that is necessary is to extract with a small amount of water, filter and evaporate in a platinum dish for total alkali and titrate for chlorids. For dehydration a small round air bath was made of Russia iron covered with asbestos and containing a rack for holding six smaller porcelain evaporating dishes. A number of experiments made with this method showed that it reduced the amount of soluble salts by about 60 per cent, while chlorids remained the same and different amounts of water could be used without affecting the results."

Soils of Mississippi, W. L. Hutchinson, W. R. Perkins, and E. B. Ferris (*Mississippi Sta. Bul. 65, pp. 19*). Chemical and mechanical analyses are given of 375 samples of representative soils from different parts of the State, together with a map showing the location and extent of the different soil areas and a discussion of the analytical results. A comparison of the analytical results with the observed productiveness of the soils shows that "other things being equal, soils containing the largest total amounts of plant food will have the most plant food available for crops . . . and the deepest surface soils give the best yields." However, other conditions, especially a uniform water supply, are also essential to productiveness. In the soils examined 0.07 to 0.1 per cent of phosphoric acid was apparently sufficient for maximum yields. Soils containing 0.05 per cent of phosphoric acid or less, required applications of phosphoric acid. All of the soils examined, except those consisting largely of organic matter, contained a sufficient supply of lime. "There is no evidence that the application of potash as a food for plants has helped or increased the yield of any crop on any soil in this State." The use of leguminous crops to increase the nitrogen supply of the soil and improve the water conditions is especially recommended. Attention is called to the unproductiveness of recently exposed subsoils.

A study of the agricultural value of the soils of Madagascar, A. Müntz and E. Rousseaux (*Bul. Min. Agr. [France], 19 (1900), No. 5, pp. 910–1123, map 1; Ann. Sci. Agron., 1901, I, No. 1, pp. 1–98, 152–160, map 1; Compt. Rend. Acad. Sci. Paris, 132 (1901), No. 8, pp. 451–456*). Chemical analyses of about 500 samples of soils collected in different parts of Madagascar, but especially in the mountainous region on the east coast, are reported, with mechanical analyses of certain of the typical soils. The samples and the regions from which they were obtained are briefly described and the results of the examinations are discussed in their relation to the agricultural possibilities of the island. The larger part of the area of the island is occupied by very ferruginous red soils. They are deficient in lime

and potash and especially poor in phosphoric acid. They are in addition very compact and impermeable and difficult to cultivate. They are easily washed by rains and harden and crack in time of drought.

The composition of some Herzegovinian and Macedonian soils, W. Busch (*Ztschr. Landw. Versuchsw. Oesterr., 3 (1900), pp. 637–694; abs. in Chem. Centbl., 1900, II, No. 25, p. 1248*). Mechanical and chemical analyses are reported of tobacco soils from these regions undertaken with a view to determining whether the quality of the tobacco was dependent upon the character of the soil or of the fertilizers used. The Herzegovinian soils were calcareous, but, with one exception, poor in calcium carbonate. The Macedonian soils were loamy, but uniformly rich in calcium carbonate. The results indicate that the brittleness of the Herzegovinian tobacco after drying as compared with the Macedonian tobacco can not be attributed to the abundance of lime in the soil. General suggestions regarding the fertilizing of the soils are made.

The geological agronomic charting of soils as a basis for their general valuation, J. Hazard (*Landw. Jahrb., 29 (1900), No. 6, pp. 805–911, charts 11*). The soils of certain areas in North Saxony are charted on the basis of their observed adaptability to the more important crops and of their geological, petrographic, and physical examination. The methods employed are described and the results obtained are reported and discussed in detail. A close correlation was observed between physical properties and adaptability to crops. The methods followed are claimed to furnish a reliable basis for the valuation of soils and for the selection of crops best suited to them.

Subterranean waters, C. Morris (*Jour. Franklin Inst., 151 (1901), No. 3, pp. 182–194, figs. 2*).—The origin, distribution, and geological functions of subterranean waters are discussed.

Contribution to the study of subterranean waters, F. Marboutin (*Compt. Rend. Acad. Sci. Paris, 132 (1901), No. 6, pp. 365–368*).—A brief account is given of a study by means of fluorescein of the source and rate of circulation in the soil of subterranean waters from which the water supply of Paris is derived.

The soils of Allegany County, C. W. Dorsey (*Maryland Geological Survey, Allegany County. Baltimore: Johns Hopkins Press, 1900, pp. 195–216*).—This article discusses the forces which are active in the formation and the factors determining the productive capacity of soils; briefly reviews previous work on the soils of the county, including that of Whitney (E. S. R., 4, p. 17; 5, p. 162), and describes 17 type soils found in the county. Mechanical analyses of these type soils and subsoils are also given.

"The soils of Allegany County are so closely related to the geological formations from which they are derived that a knowledge of the rock formations throws much light upon the soils which are found there." The type soils described are therefore given the names of the geological formations from which they are derived.

Analyses of rocks in the laboratory of the U. S. Geological Survey, 1880–1899, F. W. Clarke (*Bul. U. S. Geol. Survey, No. 168, pp. 308+XIII*).—This is a revised edition of the second part of Bulletin 148 of the Survey, and includes, in

addition to analyses of various rocks and minerals, detailed mineral analyses of clays, soils, etc.

On the examination of soils with reference to assimilable plant food, O. KELLNER (*Fühling's Landw. Ztg., 50 (1901), No. 2, pp. 71, 72*).—Referring to Meyer's recommendation (see p. 1020) that ammonium chlorid solution be used for the determination of the assimilable lime in soils, the author calls attention to his earlier experiments with the same method which were reported in 1887.[1]

The determination of assimilable lime in soils, D. MEYER (*Fühling's Landw. Ztg., 50 (1901), No. 3, pp. 128, 129*).—A reply to Kellner's claim of priority regarding the method used by the author (see above).

Need for humus in soils of western Kansas, R. W. CLOTHIER (*Industrialist, 27 (1901), No. 19, pp. 241–243*).—A brief explanation of the causes of the decrease of humus in these soils and the urgent need of restoring it.

What rôle does humus acid play in nature? H. BORNTRÄGER (*Oesterr. Chem. Ztg., 3 (1900), No. 21, p. 516*).—The action of humus acid in absorbing moisture and fertilizing constituents and giving them out again as required by the growth of plants is briefly explained.

The cultivation of the soil in warm regions, G. PATUREL (*Ann. Agron., 27 (1901), No. 1, pp. 45–62, fig. 1*).—This article describes the climatic conditions in Tunis and reports results of experiments on the influence of cultivation on the conservation of moisture in the soil of the southern or arid portion of this country. The results of these experiments show that by deep and thorough cultivation the rainfall of the period from November to April may be stored and conserved to such an extent that the growth of crops during the dry months, May to October, may be decidedly promoted and the amount of irrigation required materially reduced.

New problems in soil inoculation, J. S. STOKLASA, F. DUCHÁČEK, and J. PITRA (*Ztschr. Landw. Versuchsw. Oesterr., 4 (1901), pp. 10–29; abs. in Chem. Centbl., 1901, I, No. 5, p. 269*).—See E. S. R., 12, p. 325.

FERTILIZERS.

Phosphorite and green manuring, A. N. ENGELHARDT (*Ztschr. Landw. Versuchsw. Oesterr., 3 (1900), pp. 631–648; abs. in Chem. Centbl., 1901, I, No. 4, p. 232*).—From 3 years' field experiments the author concludes that the soils which responded to applications of fine-ground phosphorite were those in which the phosphoric acid was in form of apparently unassimilable organic compounds not set free by calcium carbonate (chalk). The fine-ground untreated phosphate was especially effective on cereals, the effect depending upon the percentage of calcium phosphate in amorphous form. The finer the meal the more effective the phosphate. The best results were obtained with rye, but the following crop of oats was also benefited. When the phosphorite was applied to rye, oats, or flax, and these crops were followed by a crop of rye to which barnyard manure was applied, the yield of the latter was much greater than that of rye which had received only an application of barnyard manure. The ground phosphorite can be profitably used to supply a deficiency of assimilable phosphoric acid on all soils which contain a sufficient amount of nitrogen, potash,

[1] Landw. Vers. Stat., 33 (1887), p. 359.

and lime. On soils which give a good yield without barnyard manure it does not prove profitable. An application of chalk improved the action of the phosphorite. How long the application of ground phosphorite may be continued with profit is a matter of doubt. When its action ceases, green manuring should be resorted to. Other mineral substances, especially marl, should be used in connection with the phosphorite.

On the utilization of fluorin gas obtained in the manufacture of superphosphates, C. ELSCHNER (*Chem. Ztg., 24 (1900), No. 75, p. 795, fig. 1*).—The gaseous fluorin products formed during the treatment of mineral phosphates with sulphuric acid are conducted through a tower into which a water spray is introduced, which absorbs the gases. The fluorin compounds thus obtained are utilized as a preservative for manure in the following way: (1) Fullers' earth and similar materials are mixed with as much sulphuric acid as they will absorb without destroying the powdery nature of the materials, and (2) a solution of the fluorin compounds obtained as above is treated with enough dried and ground clay to convert the fluosilicic acid into stable salts. Equal parts of the two preparations when mixed and sprinkled over the moist manure generate fluosilicic acid.

The guano deposits of Eritrea, G. AMPOLA (*Staz. Sper. Agr. Ital., 34 (1901), No. 1, pp. 53–59*).—Analyses and tests on different crops are reported.

An experiment on soil improvement, C. S. PHELPS (*Connecticut Storrs Sta. Rpt. 1899, pp. 205–208*).—This is a brief account of experiments begun in 1899 to test the relative value of (1) stable manure, (2) a complete chemical fertilizer, and (3) green manures, both alone and in combination with mineral fertilizers, as means of improving worn-out soils. The experiments are being conducted on eighth-acre plats. The same crop will be grown on the whole field in the same year and the crops will vary from year to year in the following order of rotation: Corn, potatoes, oats and peas for fodder, and soy beans. The yields of corn and stover from the different plats in 1899 are given without comment.

The distribution of fertilizers and their effects, BERTHAULT (*Ann. Agron., 26 (1900), No. 9, pp. 417–430*).—Experiments at Grignon and elsewhere bearing upon the effectiveness of fertilizers applied in rows, hills, and broadcast are reviewed. These, it is claimed, show that fertilizers are most effective when localized in the soil (as in hills and drills) and not distributed throughout its mass (as in broadcast application). By localization the fertilizing constituents are protected from absorption by the soil and kept available for the plant. Practical methods of securing this localization under different conditions are explained.

The phosphate industry in the United States, K. PIETRUSKY (*Oesterr. Chem. Ztg., 4 (1901), No. 2, pp. 33–36*).—A brief account of this industry, compiled from data reported in *The Mineral Industry*, volumes 1 to 8.

The preparation of marketable superphosphates, C. ELSCHNER (*Chem. Ztg., 25 (1901), Nos. 7, pp. 68, 69; 8, pp. 81, 82*).—Brief descriptions are given of various patented and unpatented processes of preparing concentrated and easily handled superphosphates.

Is the arsenic in superphosphates harmful? A. STUTZER (*Deut. Landw. Presse, 28 (1901), No. 9, p. 61*).—The percentage of arsenic in superphosphate (usually 0.011

to 0.02 per cent, sometimes as high as 0.05 per cent) is considered entirely too low to render plants grown on soils fertilized with superphosphates poisonous, as has been suggested in regard to barley used for beer making.

Potash in agriculture, G. SMETS (*La potasse en agriculture. Maaseyck: Vanderdonck-Robyns, 1900, 2. ed., pp. 44, pls. 7*).—This is the second edition of this brief treatise on the use of potash as a fertilizer, which is based mainly upon the results of experiments made by the author in Belgium.

Analyses of commercial fertilizers, M. A. SCOVELL, A. M. PETER, and H. E. CURTIS (*Kentucky Sta. Bul. 88, pp. 125–173*).—This bulletin contains a statement of the number of brands of fertilizers collected and examined, the general results of the analyses, explanations regarding free analyses, the terms used in reporting analyses, and the valuation of fertilizers, and tabulated analyses and valuations of 361 samples. Of the samples analyzed, "72, representing 55 brands and 22 firms, fell so far below the guaranteed analyses in phosphoric acid, nitrogen, or potash, or in two or all three of these ingredients as to be unaccounted for by variations in sampling or analysis."

Report of analyses of commercial fertilizers for the spring and fall of 1900, L. L. VAN SLYKE and W. H. ANDREWS (*New York State Sta. Bul. 177, pp. 37–97*).—The results of analyses of 450 different brands of fertilizers are reported. Of these 326 were complete fertilizers in which the nitrogen varied from 0.44 to 8.15 per cent, averaging 2.16 per cent. The amount of water-soluble nitrogen varied from 0 to 7.1 per cent, averaging 0.89 per cent. The available phosphoric acid varied from 1.2 to 17.47 per cent, averaging 8.9 per cent. The potash varied from 0.27 to 12 per cent, averaging 4.84 per cent. In 64 out of the 326 brands examined, the potash was in the form of sulphate free from an excess of chlorids. The average amounts of nitrogen, available phosphoric acid, and potash exceeded the guaranteed averages by 0.1, 1.28, and 0.41 per cent, respectively. The average retail selling price of the fertilizers was $27.20, the retail cost of the separate ingredients unmixed, $19.72.

FIELD CROPS.

Various conditions affecting the malting quality of barley, J. M. H. MUNRO and E. S. BEAVEN (*Jour. Roy. Agr. Soc. England, 3. ser., 11 (1900), pt. 2, pp. 185–251, pls. 11*).—A comprehensive paper treating of the following phases of the subject: Varieties; cross fertilization; coincident relations of size of grain, maturation, and percentage of nitrogenous matter; physiological aspect of maturation and overmaturation; conditions affecting quality, as climate, soil, culture, and change of seed; and the effects of cultural treatment of barley grown after roots, deducible from the Rothamsted rotation plats. Under the latter caption the results obtained at Rothamsted with barley grown continuously on the same ground 48 years, and also in a 4-year rotation of roots, barley, clover (or beans) and wheat for 52 years or 13 complete rotations, are considered. On some plats the roots in the rotation were fed on the land while on others they were removed. Fallow was regularly substituted for clover (or beans) on some plats.

Malting barleys most generally grown in the United Kingdom are the narrow-eared two-rowed variety (*Hordeum distichum*), of which Chevalier is the main type grown, and the wide-eared variety Gold-

thorpe. The Goldthorpe types show greater tendency to deterioration than the Chevalier. On the other hand they possess a stouter straw and have the ability to stand up under weather conditions that would lodge Chevalier. A number of other subspecies and varieties of barley are considered and some data and illustrations given of early types of barley. The wide-eared type of barley is thought to be the older.

Relative to the improvement of varieties of barley the author states that—

"the heavier the straw, the coarser and therefore the lower in value will be the grain generally. A low ratio of grain to straw usually goes along with grain with high content of nitrogenous matters and defective maturation. A large coarse grain of high weight per bushel is not as good malting material as a smaller grain well matured. In fact (given vitality) maturation is the most important quality of barley from a malting point of view and generally with the varieties at present cultivated the smaller grain is the better matured. If by means of selection or cross fertilization varieties of larger body but maturing equally well can be secured, a great step in advance will be made."

The subject of maturation is considered at considerable length:

"Maturation is physiologically a post-ripening process, the character of which depends largely on the preripening and this in turn on the soil conditions. Too early ripening on thin soils, due to drought and too late ripening on strong soils, both give a highly nitrogenous grain which will not mature well even under favorable natural conditions and is always more or less steely and unworkable. Even with well-ripened grain, maturation depends on sufficient time being allowed before and after cutting, but above all on weather conditions."

In the Rothamsted experiments with barley the roots on certain plats were unmanured. Other plats received superphosphate only, while others received mixed minerals and nitrogenous material. The effect of these fertilizers on the barley crop are summarized as follows:

"The good effect of soluble phosphates on quality of grain is most marked. The plats manured with minerals only have given the best yield of grain in proportion to straw, showing the unmistakable effect of phosphates in assisting grain formation. This series of plats also shows a lower percentage in the grain of nitrogenous matters than either of the other series. The barley, though often comparatively small, is well matured—better in this all-important respect than where no phosphates are applied, and also better than where, with heavy nitrogenous dressings in addition to minerals for the preceding roots, the land is in better condition and gives much higher yields."

There was not much difference as regards quality of barley whether the roots in the rotation plats at Rothamsted were fed or removed, though the yields were much heavier on the "fed" plats. The maturation of the grain was frequently, but not always, better where the roots were removed. This difference was counterbalanced in a measure by the higher relative market value of the grain from the "fed" plats. The general opinion that the feeding of roots on the land with oil cake added to the ration is too good a preparation for barley, especially as regards the quality of the barley grown on such land, was not controverted in these experiments. The authors believe that all the

various cultural conditions combined have less influence on quantity and quality of produce than has the weather; and the fact that barley does not want for quality too high a condition of soil points to the wheat crop as the best preparation for barley.

Some tests relating to the culture of barley, A. PAGNOUL (*Ann. Agron., 26 (1900), No. 11, pp. 561–567*). Some pot experiments were made to determine the influence on barley of (1) growing in sandy, clayey, and limy soils, respectively; (2) of excessive dryness or humidity, and (3) of an excess of phosphoric acid or nitrogen. Rust seriously attacked the plants, but the results obtained are thought to be comparative. Pots of each of the different soils were placed in two groups. One group received about the same amount of water as would fall naturally in a dry year; the other, double this amount, or corresponding to a naturally wet year. Three pots in each group received nitrogen and 3 phosphoric acid in excess. The yields obtained in the well-watered pots were more than double for straw and nearly double for grain those obtained in the scantily watered pots. Nitrogen increased the yield of straw, but the yield of grain was less than where phosphoric acid had been used. It also increased the nitrogen content and diminished the starch content of the grain. The phosphate, on the contrary, yielded harder, drier grain, containing less nitrogen and richer in starch and phosphoric acid.

Field experiments with fertilizers, W. O. ATWATER and C. S. PHELPS (*Connecticut Storrs Sta. Rpt. 1899, pp. 168–204, dgms. 3*). This report includes the results for the last three years of experiments on corn, cowpeas, and soy beans, to determine the effects of nitrogen in different quantities and combinations in the fertilizers applied and, further, the results of a rotation soil test. The results for each of the three years are given in tabular form and discussed at some length. The experiments have now been carried on for a number of years. The results of the soil test for a period of ten years are summarized. Previous reports have been given in former publications (E. S. R., 9, p. 746). The fertilizer applications consisted of quantities of bone-black, furnishing 53 lbs. of phosphoric acid per acre; muriate of potash, furnishing 82 lbs. of potash per acre; and different quantities of nitrate of soda and sulphate of ammonia, giving 25, 50, and 75 lbs. of nitrogen per acre.

The experiments with corn showed that a fertilizer application of nitrogenous and mineral fertilizers is much more effective than mineral fertilizers alone. Quantities of nitrogenous fertilizers supplying from 25 to 50 lbs. of nitrogen per acre, in connection with liberal quantities of phosphoric acid and potash, are recommended. In most cases, the largest percentages of protein in the crop were found where the largest quantities of nitrogen were used in the fertilizers. The yield of the leguminous crops was but slightly increased by the use of

nitrogenous fertilizers as compared with the use of mineral fertilizers. The average results in the experiments with cowpea fodder showed no advantage in the use of nitrogenous fertilizers.

In the test with soy beans grown for seed the increase due to nitrogen in the fertilizers was small. The authors infer that where mineral fertilizers are abundantly available, nitrogen has very little beneficial effect on either the total yield or the feeding value of cowpeas and soy beans.

The results of the soil-test experiments indicated that the fertilizer requirements depended more upon the crop grown than upon the soil. Corn and oats seem to require phosphoric acid and nitrogen, and potatoes potash. The indications in connection with soil tests, conducted throughout the State for a number of years, are that in many cases it is the soil rather than the crop which regulates the fertilizer requirements. From these results it is inferred that it is necessary to study and test a soil to learn its deficiencies and needs.

Fertilizer experiments during 1900, C. A. MOOERS (*Tennessee Sta. Bul., Vol. XIII, No. 3, pp. 23, figs. 3*). The experiments reported in this bulletin consist of tests with fertilizers on potatoes, corn, cowpeas, and peanuts, and the effects of fertilizer applications on the germination of the seeds of these crops. The results are given in tabular form and discussed.

The experiments with potatoes showed the best results from the use of a complete fertilizer containing high percentages of nitrogen, phosphoric acid, and potash. Cotton-seed meal proved a more profitable source of nitrogen than nitrate of soda, and a mixture of the two was unprofitable. Potatoes fertilized with a complete fertilizer averaged 2.74 per cent higher in starch than potatoes grown without fertilizer, and 1 per cent higher than those fertilized with nitrogen and phosphoric acid only. Potatoes grown on the Cumberland Plateau averaged 0.79 per cent higher in starch than those grown in the Tennessee Valley. The use of fertilizers in growing corn on rich soil was not profitable, but on soil of even more than average productiveness, which had produced corn and small grains consecutively for many years, the yield was profitably increased by heavy applications of acid phosphate and nitrate of soda. It was shown that phosphoric acid was the most necessary element. Nitrogen in the fertilizer increased the protein content of the grain. With cowpeas, phosphoric acid produced a larger yield of pods and peas than when applied in conjunction with potash, but the use of the two elements produced a larger yield of cowpea hay. Nitrogen was not found advantageous, and potash used alone was unprofitable. In the experiments with peanuts, nitrogen applied with phosphoric acid and potash lowered the grade of the nut by producing a thicker hull.

It was found that fertilizers had a decidedly unfavorable effect on the germination of seed, and it is considered best that the fertilizer should not be brought in direct contact with it.

A three-year rotation of crops with potatoes, rye, and clover, H. J. WHEELER and J. A. TILLINGHAST (*Rhode Island Sta. Bul. 74, pp. 53–74*). In this bulletin the authors discuss the advantages of crop rotations, outline the experiments conducted, give the detailed history of the different plats on which the experiments were made, and report the yields obtained, with the financial results. The rotation was conducted on 3 plats of extremely exhausted soil. The plan of the rotation was potatoes on clover sod the first year, winter rye the second year, and clover the third year. Commercial fertilizers were used for potatoes and winter rye.

In the first course of the rotation, plats 11, 13, and 14 yielded 60, 75, and 117 bu. of merchantable potatoes per acre, respectively, and in the second course 233, 268, and 193 bu., respectively. During the first course the value of the crops was less than the total expenses in five out of nine instances, and the average loss per year amounted to $6.79 per acre. This loss was offset by an average annual profit of $23.54 per acre during the second course of the rotation. For the entire period of 6 years the average net profit was $16.75 per acre each year. The results further showed an improvement in the general condition of the soil.

Four-year rotation of crops with Indian corn, potatoes, rye, and clover, H. J. WHEELER and J. A. TILLINGHAST (*Rhode Island Sta. Bul. 75, pp. 77–102*).—This bulletin contains a detailed description of the conditions under which the rotation tests were carried on and a presentation of the results obtained. The first year Indian corn was grown on clover sod, followed by potatoes the second year, winter rye the third, and common red clover the fourth. Barnyard manure was applied only before corn, and commercial fertilizers were used for potatoes and rye.

The yields are given in the following table:

Comparison of yields of the different crops in the first and second course of the rotation.

	Corn.			Potatoes.		Rye.			Clover.	
	Year.	Yield of shelled corn per acre.	Yield of stover per acre.	Year.	Yield per acre.	Year.	Yield of grain per acre.	Yield of straw per acre.	Year.	Yield of hay per acre.
First course:		*Bushels.*	*Tons.*		*Bushels.*		*Bushels.*	*Tons.*		*Tons.*
Plat No. 18	1893	7.14	0.93	1894	173.92	1895	....	0.40	1896	4.56
Plat No. 20	1896	66.29	1.93	1893	109.17	1894	29.46	1.30	1895	.39
Plat No. 22	1895	47.86	1.05	1896	267.17	1897	28.13	1.91	1894	....
Plat No. 24	1894	50.07	1.66	1895	121	1896	29.20	1.60	1897	2.55
Second course:										
Plat No. 18	1897	89.36	3.23	1898	300.50	1899	24.46	2.59	......	....
Plat No. 20	1900	85.93	3.14	1897	267.84	1898	16.25	1.57	1899	1.52
Plat No. 22	......	....	....	......	....	......	....	....	1898	2.77

In several instances accidental failures took place, and in the second course of the rotation the experiments on some of the plats were discontinued. The two plats carried completely through the two courses of rotation showed net losses of $18.40 and $44 per acre in the first course, but in the second course they showed gains of $80.70 and $64.40 per acre, respectively.

Researches on the growth of forage plants, MONVOISIN (*Ann. Agron., 26 (1900), No. 2, pp. 77–103*). A study was made of the water, ash, and nitrogen content of vetch, crimson clover, lentils, sainfoin, alfalfa, blue melilot, Italian and English rye grass, and a number of less known forage plants at different stages of growth. The weights of the stem and roots, etc., were also determined.

The roots of perennial plants were found to represent a rather high weight in proportion to the stems. After the seeds mature a constant loss of dry matter was found to occur. The mineral matter was greater in the roots than in the stems and more abundant in perennials than in annuals. It was highest at a period intermediate between the beginning of vegetation and flowering, and diminished toward the end of vegetation. In these investigations the nitrogenous material of the different plants was greater April 26 than at any period thereafter.

Grains, forage crops, and plants for green manuring, A. J. MCCLATCHIE (*Arizona Sta. Rpt. 1900, pp. 155–158*). The experiments with grains included tests of wheat grown for milling purposes, and the determination of the best varieties of cereals for hay. Of fifteen varieties of wheat tested, Rugby yielded as high as Sonora, the standard variety of the region, and No. 1174 of the U. S. Department of Agriculture from Turkestan ripened in as short a time. The results further indicated that Sonora wheat yields best when sown soon after November 1. Wheat sown broadcast and irrigated by furrows gave the best returns, as compared with other methods of irrigating. Feldspar wheat produced a better hay than Sonora, and the hulless and beardless varieties of barley were considered preferable to bearded varieties for hay.

Club-head sorghum was the best yielding forage crop. Kafir corn was next to sorghum in yield. Teosinte gave a good yield of good fodder but required too much water to be desirable for that region. Egyptian corn was the best heat and drought resisting of the forage crops tested. Yellow sweet clover (*Melilotus indica*) proved a better plant for green manuring, under the conditions, than alfalfa and lupines.

Grass experiments, W. CARRUTHERS and J. A. VOELCKER (*Jour. Roy. Agr. Soc. England, 3. ser., 11 (1900), pt. 1, pp. 116–138*). The results are given of 22 trials in 11 counties of England in the improvement of pastures by fertilizing. In 10 cases where analyses showed a lack of phosphoric acid, the addition of fertilizers containing that

chemical was found profitable in practice. The same fact was borne out in the case of lime, chemical analyses indicating where it could be profitably used. Basic slag was found to be a valuable fertilizer for pastures, and its influence continued through several seasons. Superphosphate proved to be valuable, but the influence was not as lasting as in the case of slag. Stable manure produced one heavy crop which was, as a rule, rejected by stock on account of the presence of the manure. The returns from its use rapidly diminished in the following season.

Memoir on the commercial culture of potatoes, M. P. Lavallée (*Bul. Soc. Agr. France, n. ser., 31 (1900), Apr. 15, pp. 461–493; May 1, pp. 535–554*).—Besides discussing the advantages of potato culture the author presents the results of experiments with potatoes along the following lines: Tests of sprouted *v.* unsprouted potatoes for seed as regards both yield and starch content of the potatoes harvested, distance experiments, planting different sized tubers for seed, experiments to determine the effect on the starch content of the crop of planting tubers containing different percentages of starch, experiments in changing the physical characters of potatoes as regards the color of skin and color and quality of the flesh, selection of different parts of the tuber for seed, and spraying to control blight, etc. Notes on potato culture and on the cost of growing potatoes are also included. The experiments extended over a period of years, and in some instances are given in considerable detail.

The results obtained in the experiments show the advantages of using sprouted potatoes for seed to be an increased total yield, increased earliness, larger starch content, and a more vigorous growth of vines. Planting tubers in rows 2 ft. apart and 1 ft. distant in the row gave better results than greater distances. It increased the yield and hastened the maturity of the crop. The tubers were better formed and richer in starch. Average sized whole tubers used for seed gave better returns than large or small sized whole tubers. Small seed, while possessing great vigor of reproduction, tends to the production of small tubers. Large tubers may be profitably cut for seed. Pieces weighing on an average 45 gm. and carrying 2 eyes were better for seed than whole tubers of the same weight. The advisability of cutting seed tubers largely hinges on the variety to be planted. With Peach Blow, Magnum, Bruce, and Maercker, the best results were obtained when the tubers were cut; while with Blue Giant, Red Skin, Hebe, and Pluto, results were generally better with the whole tubers. No decided results were obtained in planting tubers of different starch content. In connection with this work the author noticed that tubers having the highest percentages of starch were usually of a dark color and not smooth. Bordeaux mixture prolonged the growing period of potatoes and increased the yield.

Experiments with sugar cane, W. MAXWELL (*Hawaiian Sugar Planters' Sta. Rpt. 1900, pp. 3-40, 43-50*). The work here reported comprises planting tests and an investigation of the chemical composition of different varieties with a view to determining the quantities of plant food removed from the soil and how they should be returned to it. The results of the planting tests are illustrated in the following table:

Different methods of planting Lahaina and Rose Bamboo sugar cane, with average results obtained.

Methods of planting	Canes per row.	Yield per acre.	Density of juice.	Sugar in juice.	Purity coefficient.	Sugar in cane.	Sugar per acre.
		Lbs.		*Per ct.*		*Per ct.*	*Lbs.*
Two continuous canes in row	382	185,660	20.72	17.57	84.79	15.74	29,212
One continuous cane in row	313	193,180	19.94	17.09	85.71	15.31	29,575
One eye per 6 in	387	194,660	19.99	16.95	84.79	15.18	29,549
One eye per 12 in	387	195,940	19.97	17.32	86.73	15.51	30,390
One eye per 18 in	359	175,036	20.00	16.95	84.75	15.18	26,570

Other experiments along this line are in progress.

Comparative tests of 13 varieties of cane, comprising 4 varieties already upon the islands and 9 introduced canes, were conducted under identical conditions. The canes used for seed were 15 months old. The relative results are given in the following table.

Results from different varieties of cane.

Varieties.	Canes per row.	Yield per acre.	Fiber in the cane.	Sugar in cane.	Sugar in juice.	Purity coefficient.	Density.	Sugar per acre.
		Lbs.	*Per ct.*	*Per ct.*	*Per ct.*			*Lbs.*
Lahaina	319	193,280	10.9	15.32	17.20	86.25	19.93	29,610
Rose Bamboo	340	209,600	9.9	14.54	16.15	85.35	18.72	30,475
Yellow Caledonia	254	182,240	11.7	12.36	14.00	78.15	17.87	22,524
Yellow Bamboo	297	158,160	12.8	13.12	15.05	81.58	18.45	20,750
Moore Purple (Fiji)	490	80,560	10.3	12.60	14.05	79.15	17.75	10,150
Demarara, No. 117	412	186,240	10.1	12.45	13.85	75.58	18.35	23,186
Demarara, No. 95	581	194,000	11.7	15.40	17.45	87.24	20.17	29,876
Demarara, No. 124	175	110,400	9.3	12.06	13.30	79.73	16.68	13,314
Louisiana, Tibboo Mird	441	241,360	9.0	13.97	15.36	84.30	18.21	33,718
Louisiana, Striped	373	239,520	9.9	14.36	15.95	85.82	18.54	34,395
Louisiana, Purple	411	153,360	10.0	13.41	14.90	83.98	17.76	20,565
Striped Singapore	353	165,040	10.9	15.08	16.93	87.19	19.40	24,888
Big Ribbon	307	232,161	11.5	11.68	13.20	73.53	17.79	27,116

Tibboo Mird and Striped, introduced from Louisiana, more than doubled their yield under Hawaiian conditions, and surpassed all other varieties that were native and used to the Tropics.

The amounts of fertilizing ingredients removed from the soil by the respective varieties, and the amounts of these elements used per ton of sugar produced, are reported in the following table:

Fertilizing ingredients removed from the soil by 1 acre of cane, and used per ton of sugar produced.

Varieties.	Fertilizing ingredients removed per acre.				Fertilizing ingredients per ton of sugar.			
	Nitrogen.	Phosphoric acid.	Potash.	Lime.	Nitrogen.	Phosphoric acid.	Potash.	Lime.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Lahaina	376	235	1,323	426	25.4	16.0	89.5	28.7
Rose Bamboo	622	209	1,746	533	40.5	13.6	114.2	34.8
Yellow Caledonia	436	191	1,477	406	38.7	16.9	131.1	36.5
Yellow Bamboo	410	170	1,709	297	39.5	16.3	164.7	28.6
Moore Purple	482	185	1,542	405	94.9	36.4	303.8	79.8
Demarara, 117	497	200	1,435	511	42.9	17.1	123.8	44.0
Demarara, 95	547	214	1,735	556	36.6	14.3	116.1	37.4
Demarara, 124	352	175	1,843	417	52.8	26.3	276.8	62.6
Louisiana, Tibboo Mird	558	290	2,360	620	33.0	17.2	139.9	36.8
Louisiana, Striped	579	255	2,311	538	33.2	14.8	134.3	31.2
Louisiana, Purple	545	188	1,725	537	53.3	18.2	167.7	52.2
Striped Singapore	474	171	1,397	457	38.9	13.7	112.2	36.8
Big Ribbon	506	236	2,128	613	37.3	17.4	156.2	45.2

The results of analyses of the mineral matter in the leaves, tops, and dead cane of the different varieties are given in tables. From July, 1898, to November, 1899, inclusive, the crop received 26.99 in. of rain and 76 in. of irrigation water. This increased the yield of sugar per acre by 23,155 lbs. as compared with results on unirrigated plats. Fertilizer tests in progress are briefly described.

Wheat experiments, C. L. NEWMAN (*Arkansas Sta. Bul. 62, pp. 17–34, fig. 1*).—These experiments embraced culture, rotation, seeding, and variety tests with wheat. Plowing deeper than 8 in. did not prove profitable. Disking and rolling the soil thoroughly before sowing and thorough preparation of the soil in general diminished winterkilling and the bad effects of drought and increased the yield materially. Sowing 5 and 6 pecks of seed per acre gave the best returns. Where cowpeas, soy beans, and beggar weed were grown on light sandy soil the yield of the following wheat crop was increased 56.5 per cent. The returns indicate that crops for green manuring should not be plowed under shortly before the crop is sown. This was shown by the fact that where stubble of leguminous plants and the whole plants were plowed under shortly before sowing, the results were generally in favor of the stubble. A crop of cowpeas grown after harvesting rye and potatoes increased the following wheat crop 30 per cent.

"Wheat grown continuously on the same ground for three years and each crop preceded by a crop of cowpeas gave an increased yield of 46.7 per cent as compared with breaking the wheat stubble and not sowing cowpeas. Fertilizing cowpeas with 200 lbs. of acid phosphate and 100 lbs. of muriate of potash increased the yield of wheat that followed 58 per cent. Wheat sown upon cowpea stubble, plowed under and fertilized with 400 lbs. of a complete fertilizer, gave an average increased yield of 64.4 and 78.5 per cent increased yield the second year over soil treated only in the usual way."

Early Ripe, Indian Swamp, Purplestraw, Pool, Red May, Red Wonder, and Tennessee Fultz gave the best results.

Wheat (*Kentucky Sta. Bul. 89, pp. 177–198, pls. 4*).—This bulletin is a report on variety and fertilizer tests with wheat. Similar work has been previously reported (E. S. R., 11, p. 731). Thirty-six varieties of wheat were grown in 1900. The yields of grain and straw per acre are tabulated for each variety. The botanical description of the varieties, with field notes on the same, and illustrations of 30 varieties, are given. Fultz wheat gave the largest yield, 52.2 bu. per acre; followed by Harvest King, 50.3 bu.; Lancaster Red, 49.9 bu.; White-seeded Golden Cross, 49.7 bu.; and Harvest Queen, 49.5 bu. Kansas Mortgage Lifter and Turkish Red produced the heaviest grain, the bushel weighing 65 lbs. The fertilizer experiments were conducted on a farm in the region of the Coal-Measures formation. The results indicated the need of phosphoric acid and humus in the soil.

Experiments with winter wheat, A. M. SOULE and P. O. VANATTER (*Tennessee Sta. Bul., Vol. XIII, No. 2, pp. 24, pl. 1, figs. 5*).—These experiments included fertilizer and variety tests, intertillage experiments, and trials of different rates of seeding, and seed selection. The work and its results are discussed at some length and the yields obtained are given in tabular form. The results on small plats were relatively correct as compared with field trials. Early and thorough preparation of wheat land is recommended. Fulcaster wheat, with a yield of 41.66 bu. per acre, was the most productive variety, followed by Early Genesee Giant, with 41.35 bu. Improved Fulcaster, Niger, Fultz, and Poole averaged over 40 bu. per acre. Velvet Chaff produced the heaviest grain, the measured bushel weighing 61½ lbs., and Fultz, Poole, Harvest King, and Deitz Amber all weighed 60 lbs. or over, although yielding more than 39 bu. per acre. The best milling wheats were Fulcaster, Niger, Mediterranean, Improved Fulcaster, and Deitz Amber, while White Golden Cross, Early Genesee Giant, and Fultz were considered the poorest. Egyptian produced the weakest straw and Early Genesee Giant the stiffest.

Among 22 fertilizer combinations tested in this connection, 10 tons of barnyard manure produced the best results, increasing the yield 11.72 bu. as compared with wheat grown without a fertilizer application. Five tons of barnyard manure per acre increased the yield 7.71 bu., at a cost of 26 cts. per bushel. A home-mixed fertilizer used at the rate of 50 lbs. of nitrate of soda, 100 lbs. of Tennessee acid phosphate, and 25 lbs. of muriate of potash increased the yield 8.07 bu., at a cost of 27 cts. per bushel.

In discussing the cowpea as a source of nitrogen in soil renovation, the authors state that "nitrogen is chiefly stored in the leaves of the cowpea plant and not in the nodules on the roots, as many suppose."

Other results obtained indicated the best time for seeding wheat to be from October 1 to 15. The intertillage experiments consisted in cultivating, with a Breed's weeder, wheat grown in rows wide apart or

close together. The results show a gain of 2.13 bu. per acre in favor of the rows wide apart. The yields from sowing wheat at the rates of 1, 1½, and 2 bu. per acre did not differ materially, but the use of 2 bu. per acre is regarded best.

A test of other winter cereals gave very satisfactory results, Common Gray winter oats yielding 39.31 bu., Excelsior winter rye 51.78 bu., and winter barley 56.66 bu. per acre. Experiments in seed selection are in progress.

Wheat culture at the agricultural school at La Réole in 1898, 1899, and 1900, P. HERBET (*Jour. Agr. Prat., 1900, II, No. 50, pp. 863, 864*).—The manner of conducting the experiments is described and observations on diseases, lodging, maturity of different varieties, and the yields are noted. On a sandy loam soil plowed 35 cm. deep, with a green manuring of crimson clover and an application of 500 kg. of superphosphate and 100 kg. of ammonium sulphate per hectare, a yield of 11 hectoliters was obtained from 3 liters of La Réole wheat sown, or 366 liters for each liter of wheat. The wheat was sown in drill rows, 35 cm. apart. The author calls attention to the advantages of selecting the seed, working the soil to a good depth, and manuring rationally. It is stated that the results confirm previous conclusions; that under existing climate and soil conditions of the valley of the Garonne a rather thin stand of wheat gives the best results.

Results of various culture and fertilizer experiments, H. E. STOCKBRIDGE (*Florida Sta. Rpt. 1899 and 1900, pp. 12-20*).—In the report of the agriculturist, several brief accounts of experimental work are given. Mexican June corn, with cowpeas as an intercultural crop, was grown after oats which were harvested late in May. Good crops of oats, corn, and cowpeas were obtained. Cultural tests with cassava resulted in the best yield from planting 4 ft. apart, with hills 3 ft. apart. A test of the continued use of Egyptian and sea-island cotton seed, without resorting to fresh supplies from the original sources, showed a decrease in yield, year by year, as the seed became removed in time from the seed originally procured. Other experiments with corn, sweet potatoes, and velvet beans are briefly described.

Field experiments (*Queensland Dept. Agr. Rpt. 1899-1900, pp. 4-11*).—A report on the field experiments, comprising culture and variety tests with potatoes, oats, malting barley, wheat, maize, millet, and various other forage plants, is here given.

Report of the agriculturist of the State experiment station at Albano, Sweden, 1897-1899, S. RHODIN (*Kgl. Landtbr.-Akad. Handl. Tidskr., 39 (1900), No. 4, pp. 207-226*).—The report deals with methods of preservation of stable manure, fertilizer experiments for the production of grass seed, further trials of Wiborgh phosphate, and experiments with standard varieties of oats at different Swedish agricultural schools.

Concerning experiments with fertilizers, BEHRENS (*Mitt. Deut. Landw. Gesell., 16 (1901), Nos. 4, pp. 14, 15; 5, pp. 17-19; 6, pp. 21, 22*).—A paper treating of the methods of conducting fertilizer experiments and the value and meaning of the results.

Experiments with phosphatic manures on cereals, E. MARRE (*Semaine Agr., 21 (1901), No. 1026, pp. 13, 14*).—A report on cooperative experiments with phosphatic manures on cereals. The results indicate that a high-grade superphosphate is most economical.

The lodging of grain, C. GUFFROY (*Jour. Agr. Prat., 1901, I, No. 2, pp. 48, 49, figs. 3*).—This article is a brief report on the study of several cereal crops grown under different fertilizer conditions, with a view to determining the relation between the fertilizer application and the lodging of grain. The conclusions are that the resistance of the grain depends upon the cellular structure of the stem, a purely mechanical quality. Phosphoric acid was shown to increase the resistance and nitrogen to decrease it. The application of both these elements in the proper proportions is considered necessary for a good yield of unlodged grain.

Four years' cooperative culture tests with barley, A. SEMPOLOWSKI (*Deut. Landw. Presse, 28 (1901), No. 3, pp. 21, 22*).—A condensed report on the results obtained with 4 varieties of barley. Hanna barley gave the highest yields of straw and grain.

Sea of Azof barley (*Jour. Dept. Agr. West. Australia, 2 (1900), No. 6, pp. 423, 424*).—Field notes on this variety of barley regarded as quick growing and suitable for early green fodder.

The quality of barley grown after roots, A. D. HALL (*Jour. Bd. Agr. [London], 7 (1900), No. 3, pp. 292–299*).—This article considers the injurious effect on the quality of barley when this crop is grown after swedes and turnips, and suggests a remedy in the method of fertilizing. The application of fertilizers in its relation to this subject was made a study at the Southeast Agricultural College at Wye, and the results showed that when barley is grown after roots that have been fed on the land a dressing of salt injures the quality of the barley, and an application of sulphate of potash, although increasing the starch content of the grain, does not give profitable results. A dressing of 3 cwt. of superphosphate per acre produced a slight increase in yield and a marked improvement in quality.

Broom corn, J. T. ROBERTSON (*Jour. Agr. and Ind., South Australia, 4 (1900), No. 5, pp. 424, 425*).—Brief popular directions for growing broom corn.

Broom corn, TRABUT (*Bul. Agr. Algérie et Tunisie, 6 (1900), No. 24, pp. 665–671, figs. 2*).—A discussion of broom-corn culture in Algeria.

Fertilizer experiments with red beets, E. O. ARENANDER (*Landtmannen, 11 (1900), No. 18, pp. 280–286*).

The castor bean (*Florida Agr., 28 (1901), No. 3, pp. 33, 34*).—This article treats of the culture and uses of the castor bean.

Fertilizer experiments with carrots, E. O. ARENANDER (*Landtmannen, 11 (1900), No. 33, pp. 527–530*).

Japanese clover, F. GAGNAIRE (*Jour. Agr. Prat., 1901, I, No. 3, pp. 93–95*).—An article discussing the first experiments with Japan clover in France and Algeria, the results of which were not promising.

Cowpeas and soy beans (*Jour. Dept. Agr. West. Australia, 2 (1900), No. 6, pp. 436–438*).—A popular article comparing the two plants.

Forage plants, B. C. BUFFUM and W. H. FAIRFIELD (*Wyoming Sta. Rpt. 1900, pp. 34*).—A report on investigations with a large number of cultivated and native forage plants, consisting of brief cultural notes on the different species and lists of promising and unpromising plants for the region, as shown by the results of trials.

Grasses and fodder plants on the Potomac flats, C. R. BALL (*U. S. Dept. Agr., Division of Agrostology Circ. 28, pp. 18*).—This report describes the trial grounds on which the grasses and forage plants were grown and notes the facts observed in connection with these tests. The seed for these trials was obtained in the United States and in foreign countries. A number of grasses from the Southwest, namely, curly mesquite, turnip grass, water grass, and sprangle made a very promising growth. The introduced Australian species showed a ready adaptability to this climate, and among them button grass and Mitchell grass made a remarkably vigorous growth. This report discusses about 60 different species, including perennial meadow and pasture grasses, millets, sorghums, teosinte, saltbushes, burnet, rape, and a large number of different leguminous crops.

Investigation on the composition of grasses from different meadows, A. EMMERLING ET AL. (*Centbl. Agr. Chem., 29 (1900), No. 12, pp. 804–807*).—The results of analyses are tabulated. The authors conclude that the food value of a grass mixture can be determined only by analysis.

Fertilizing meadows on granitic soils, L. GRANDEAU (*Jour. Agr. Prat., 1901, I, No. 2, pp. 45, 46*).—This article compares the use of superphosphate and Thomas slag in this connection, and concludes that under the conditions which are discussed Thomas slag is the more profitable.

Management of ensilage crops, A. M. SOULE (*Univ. Tennessee Record, 4 (1901), No. 1, pp. 68–75, figs. 5*).—A general discussion of the subject.

Revised notes on the cultivation of broom millet for manufacturing purposes, A. A. DUNNICLIFF (*Agr. Gaz. New South Wales, 11 (1900), No. 12, pp. 1124–1129*).—Popular notes on soil and seed requirements of broom corn, and on the planting, cultivating, harvesting, curing, and baling of the crop. A number of the most suitable varieties are described.

Observations on the culture of oats, RAYNAUD and BRUNERIE (*Semaine Agr., 21 (1900), Nos. 1027, pp. 22, 23; 1028, pp. 29, 30*).—A résumé of cultural notes on oats during the years 1893–1899.

Potatoes, A. J. MCCLATCHIE (*Arizona Sta. Rpt. 1900, pp. 161, 162*).—In a variety test with potatoes, Burpee Early matured first and gave a yield equal to that of Early Rose, a variety commonly grown. Early Rose planted February 7 yielded one-third more than when planted January 17. Triumph also gave promising results. Potatoes planted 9 in. apart in a row gave the best results as compared with other distances. Chile saltpeter applied at the rate of 500 lbs. per acre did not prove profitable.

The effect of shortening the root before planting root crops, KUNATH, (*Deut. Landw. Presse, 27 (1900), No. 103, pp. 1237, 1238, figs. 3*).—The opinions of different agricultural writers on the subject are given, and the results of experiments by the author along this line with celery are reported.

Conditions affecting the feeding value of mangolds and swedes, J. S. GORDON (*Jour. British Dairy Farmers' Assoc., 15 (1900), pt. 2, pp. 25–33*).—A description of experiments is given and the results obtained are tabulated. It was found that the best yielding variety does not contain the most nutriment, and that large roots are not so nutritious as small roots. Heavy manuring retarded the maturity of the crops.

Our saltbushes, T. E. GRIGG (*Agr. Gaz. New South Wales, 11 (1900), No. 12, pp. 1120, 1121*).—A popular discussion of the value of different varieties of saltbush.

Sugar beets, A. J. MCCLATCHIE, R. H. FORBES, and W. W. SKINNER (*Arizona Sta. Rpt. 1900, pp. 163–165, 184, 185*).—The experiments here reported were conducted mainly for the purpose of testing methods of irrigation. Two plats of beets, sown December 26 and January 23, and first irrigated April 1 and April 3, respectively, produced beets high in sugar content and purity. The yield on the plat sown in December was 14.5 tons per acre and on the other, 10.4 tons. These results indicate that the best time to begin irrigating is when the beets are from 2 to 3 months old.

In addition to this work, sundry tests with beets were made on the Upper Gila, and the results are given. The season was adverse to the success of the experiments and the work is to be continued.

Experiments on the culture of sugar beets at Cappelle (*Jour. Agr. Prat., 1901, I, No. 3, pp. 78, 79*).—This is a report on a test of four different strains of sugar beets, designated as short, early, medium (*demi-longues*), and late. For three years in succession the medium sized and late maturing strains have given a larger yield in beets and in sugar than the short and early ripening strains. The results for 1900 are given in a table.

Planting small beets for seed production, E. SCHAAF (*Bl. Zuckerrübenbau, 7 (1900), No. 24, pp. 369–376, fig. 1*).—A discussion of the size of the beet to be used for this purpose.

Phosphoric acid as a fertilizer for sugar beets, G. Smets (*Belg. Hort. et Agr., 12 (1900), No. 24, pp. 374, 375*).—Note on the results of several experiments on the subject.

Applying nitrate of soda as a top-dressing in sugar-beet culture, L. Grandeau (*Jour. Agr. Prat., 1901, I, No. 1, pp. 17, 18*).—This article is a discussion of experiments along this line, the results of which are not regarded as quite conclusive. The author suggests further investigation on the subject.

Sugar beet statistics for the year 1899–1900 (*Bul. Min. Agr.* [*France*], *19 (1900), No. 5, pp. 900–902*).—Tables showing the quantities of beets worked and the quantities of sugar and by-products obtained.

Report of the tobacco expert, R. S. Nevill (*Queensland Dept. Agr. Rpt. 1899–1900, pp. 37, 38*).—A brief report on tobacco work in Queensland.

Experiments with wheat at the agricultural experiment station at Chevilcoy, J. R. Chavex (*Bol. Mens. Agr. y Gan., 2 (1900), No. 2, pp. 66–70*).—A report on variety and culture tests with wheat.

Wheat in the Fassifern District (*Queensland Agr. Jour., 7 (1900), No. 6, p. 498, pls. 2*).—A note on growing Allora spring wheat in that region.

Minnesota No. 163 wheat, W. M. Hays and A. Boss (*Minnesota Sta. Class Bul. 8, pp. 4*).—A popular bulletin giving a comparison of this wheat with other varieties, based on the results of tests made at the station. Comparative tests with this wheat were carried on throughout the State, and the results thus far obtained are discussed. In general this new fife wheat yielded more than the varieties with which it was compared.

Rietti wheat (*Agr. Jour. Cape Good Hope, 17 (1900), No. 13, pp. 783, 784*).—A tabulated report on cooperative experiments with this variety.

Variety tests of wheat, oats, and barley, B. C. Buffum and W. H. Fairfield (*Wyoming Sta. Rpt. 1900, pp. 44*).—A brief description of the variety tests with wheat, oats, and barley is given, and the results of testing about 500 varieties of wheat, over 60 varieties of oats, and about 50 varieties of barley during the years 1896–1899, inclusive, are tabulated.

Work at the agricultural experiment station at Baradero, D. del Castillo (*Bol. Mens. Agr. y Gan., 2 (1900), No. 2, pp. 54–63*).—A report on variety and culture tests with wheat, barley, oats, and rye conducted at the station.

Manuring wheat in dry country (*Agr. Gaz. New South Wales, 11 (1900), No. 11, pp. 1008–1011*).—A series of opinions on the subject by wheat growers in the arid districts of Australia.

The reasons for the low yield of wheat in recent years (*Braunschweig Landw. Ztg., 69 (1901), No. 2, pp. 7–10*).—A discussion of the subject at a meeting of the Central Agricultural Society of the Province of Braunschweig.

HORTICULTURE.

Utilizing the greenhouse in summer, F. W. Rane (*New Hampshire Sta. Bul. 76, pp. 135–143, figs. 9*).—A brief account is given of growing tomatoes, muskmelons, celery, cucumbers, sweet potatoes, eggplant, and peppers under glass in summer.

With tomatoes the varieties Early Acme, Beauty, New Liberty Belle, Ignotum, Fordhook First, and Bond Early Minnesota were used. Picking began about July 10, and lasted a month before the field varieties were ripe. The yield of the tomatoes grown in the greenhouse averaged 2 lbs. 6½ oz. per square foot, and the average price between July

10 and August 10 was 7 cts. per pound, thus giving a money value of 16.8 cts. per square foot. The vines continued bearing until August 30. At this date the average yield per plant was 5 lbs. 3⅓ oz. per square foot, and the selling price per pound brought the money value up to 20 cts. per square foot.

Peppers were not fruited out of doors. Under glass the large squash pepper yielded at the rate of 160½ lbs. per square rod, and Ruby King at the rate of 122 lbs. per square rod.

Eggplants gave an average return of about 18 cts. per square foot. Early Long Purple gave the quickest returns and was very productive. New York Improved stood next in value.

Celery was easily grown, but there was considerable difficulty in blanching without rotting. The Golden Self Blanching was of most value for indoor culture.

Muskmelons were started in pots and handled similar to cucumbers. It required about 3 months from the time the plants were transplanted into the beds until the fruit matured. Varieties successfully grown were Rose Gem, Netted Gem, and true Jenny Lind.

From the results of the author's experiments with these different vegetables, it is believed that owners of greenhouses can ill afford to allow the house to remain idle throughout the summer. This is believed to have special application to the New England States and those in temperate sections.

The growing of lettuce with chemical fertilizers, W. STUART (*Indiana Sta. Bul. 84, pp. 115-142, charts 3*).—Previous experiments (E. S. R., 11, p. 342) are reviewed and details given of further work to determine the comparative efficiency of chemical fertilizers and stable manure, relative availability of liquid chemical manures when applied to the surface of the soil and from below, and a comparison of surface *v.* subwatering for lettuce. The tests were made in pots, and the results are tabulated and discussed. The author summarizes the results of the present and earlier tests as follows:

"In order to study the action of the three essential elements of plant food—nitrogen, phosphorus, and potassium—a soil must be used that is fairly deficient in plant food. Potash when used in any considerable amount, either alone or in connection with nitrate of soda, produced conditions unsuitable to plant growth. When phosphoric acid was used alone or in connection with nitrate of soda or muriate of potash, even in large amounts, a marked increase in the growth of the plants was obtained. The muriate of potash proved somewhat superior to the sulphate, the increase in each case being but slight. But little difference seems to obtain in the efficiency of different forms of available phosphoric acid. In each instance chemical fertilizers proved slightly superior to stable manures. The application of liquid fertilizers from below by the subwatering method proved perfectly feasible and gave satisfactory results. Nitrate of soda gave quicker returns than did dried blood, and seems best adapted to lettuce culture. The subwatered plants made a better growth than the surface-watered ones."

Methods of apple cultivation on light porous soil, R. GOETHE and E. JUNGE (*Ber. K. Lehranst. Obst, Wein u. Gartenbau, Geisenheim, 1899–1900, pp. 13–15*).—The soil in this experiment was so porous that week-long continued rain was not sufficient to make it too wet. The orchard was divided into sections and treated as follows: (1) Irrigated 4 times with kitchen slop water; (2) the surface soil cultivated, thoroughly forming a loose mulch; (3) blue lupines grown, which were mowed during the summer and left on the ground for the purpose of preserving soil moisture; and (4) soil removed 3 cm. deep over an area of 12 square meters and piled in a ridge about the tree forming a dam for the preservation of all snow and rain water. No other cultivation was given. Another parcel was seeded to vetch. The control plat was spaded in the spring and hoed once during the summer, as is the custom in the locality.

Trees on parcel 1 made a good healthy growth and the fruit developed well. Equally as good results were secured on parcel 2, where the moisture was retained by thorough cultivation. On plats 3 and 5, which were seeded with blue lupines and vetch, respectively, the tree growth was poor and the fruit remained small and dropped early to the ground. The small amount of snowfall did not permit of a thorough test of the value of the earth dam about trees in parcel 4. The trees on the control plat were behind the trees grown on parcels 1 and 2 in every respect.

The essentials of peach culture, J. H. HALE (*Rural New Yorker, 60 (1901), No. 2658, pp. 1, 2, fig. 1*).—The soil and the tree and its care are considered. The author advises the use of trees 5 to 6 ft. high and ¾ in. in diameter for planting. The top is unimportant, but there should be a heavy root and a strong cane 15 or 18 in. up. The author has been most successful in planting trees 13 ft. apart each way, or less. Such close planting requires much pruning and for general planting 18 to 22 ft. apart each way is advised. In the South closer planting than in the North may be observed. Catch crops should not be planted in the young orchard, but instead 12 to 15 good cultivations given.

During the first 2 years, after a month or 6 weeks of thorough cultivation, cowpeas may be seeded over two-thirds the space between the rows, leaving space each side of the trees for single-horse cultivation for 2 months more. The pea vines should be left in the ground over winter as a mulch. After the first 2 years, the whole space between the rows should be cultivated up to the last of July or first of August, and then seeded completely with 15 or 20 lbs. of clover for winter protection of the peach roots. The clover should be plowed under in the early spring before much growth takes place.

In pruning a light open head is desired. The first season's growth should not be shortened too much, but the second season all the strong-

est branches may be liberally shortened, leaving the side branches to spread so as to make a broad low head. In case it seems best not to cut a leader entirely away, never cut back to a dormant bud, but always to some side branches; these will slowly take on growth and fruiting strength and check the upward tendency of growth that is sure to follow the cutting back of a strong peach limb to a dormant bud. Not much attention need be paid the side branches; they will never make leaders, and in the author's opinion it is a mistake to do so. A tree pruned as here suggested should give three-fourths of its fruit near enough to the ground so that it can be gathered without a ladder.

Winter irrigation of orchards, A. J. McClatchie (*Arizona Sta. Rpt. 1900, pp. 162, 163*).—Previous experiments along this line have been continued (E. S. R., 11, p. 847). Water was withheld from orchards heavily irrigated during the winter, from June to December, and irrigated again from December to March. The March irrigation was followed by plowing and harrowing and the orchard harrowed again after two slight showers in April to break up the crust that formed over the surface.

"Though having passed through the driest hot period of which there is a record in the valley, the trees are now (July) in the best of condition. The apricot trees have made a young growth of 3 to 6 ft., and the peach trees a growth of about 4 ft. The apricot trees all matured a good crop of fruit, and many of the peach trees are unusually heavily loaded."

A peach and apricot orchard was sown to clover during October and from then until April was irrigated sufficiently to keep the crop growing well. Samples of soil in this orchard taken to a depth of 33 ft. showed that it had been wet to as great a depth as in an adjoining orchard in which nothing had been sown. The results of these experiments are believed to prove "that green manuring and winter irrigation may go hand in hand to excellent advantage."

Growing and grafting resistant vines, F. Gillet (*Pacific Rural Press, 61 (1901), No. 8, p. 116*).—The author reports his experience in bench grafting resistant stock. The best results have been obtained on Riparia. One or two year old rooted cuttings are used in preference to plain cuttings because of a gain of one year in time, and because a larger percentage will grow. In field practice the author used rooted cuttings just grafted and rooted resistant stock in alternate rows. While succeeding with 85 to 90 per cent of the former, only 60 per cent of the grafts of the latter grew, and these produced hardly any grapes that year, while on the former from 8 to 11 lbs. per plant were secured. On the whole, bench grafting resistant vines is considered the best, cheapest, and quickest way of reconstructing a vineyard or starting a new one.

Fertilizer experiments with nitrate of soda in the red wine district of the Ahr Valley (*Ber. K. Lehranst. Obst, Wein u. Gartenbau, Geisenheim, 1899-1900, pp. 103-107*).—Experiments were made

in different mountainous districts to determine the influence of nitrate of soda on grapes and the effect of early and late applications. The soil was naturally well supplied with mineral matter. The nitrate was applied at the rate of 300 kg. per hectare. It was especially effective on the steep hillsides. Its influence was noticeable in the greater wood growth, the larger size of the fruit, and the darker green of the leaves. The leaves also hung on the vines about two weeks longer than where no nitrate was used. Even late applications of nitrate of soda produced no harmful effects. The good effect of the nitrate was not so noticeable in rich, humus, clay soils in the valleys. The must from the fertilized and unfertilized plants showed no essential difference in specific weight, sugar or acid content, and the wine was similar in chemical character. There was considerable difference, however, in the nitrogen content of the wine, that from the fertilized vines being 10 per cent higher than that from the nonfertilized vines. The leaves of the fertilized vines were likewise richer in nitrogen.

In conclusion, the author states that no harmful influence whatever could be detected from the use of nitrate of soda, even with late applications. Wherever differences were noticeable they were always in favor of the nitrate.

Gardening in Germany, L. Wittmack (*Gartenflora, 50 (1901), Nos. 2, pp. 38–44; 3, pp. 70–74; 4, pp. 94–96*).—The historical development and present status of vegetable, flower, and fruit gardening in Germany is considered, some statistics on seed production, fruit imports and exports, cut-flower and plant production being included.

Vegetables, A. J. McClatchie (*Arizona Sta. Rpt. 1900, pp. 158–161*).—Cultural notes and the results of tests of varieties of cabbage, lettuce, watermelons, onions, and cauliflower. Succession, Fottler Brunswick, Large Late Drumhead, and All Seasons cabbage gave the heaviest yields per acre. New York and Tyrol produced the largest heads of lettuce. Of the watermelons tested Augusta proved the most satisfactory. In the culture experiments with onions slightly better results were secured when the plants were sown in place and thinned than when they were transplanted. The variety Prize Taker gave the heaviest yield and produced the best quality of onions.

Asparagus culture, E. Lesser (*Landw. Wchnbl. Schleswig-Holstein, 51 (1901), No. 5, pp. 82, 83*).—Method of culture and best varieties are considered.

Forcing haricots, C. Potrat (*Belg. Hort. et Agr., 13 (1901), No. 1, pp. 7, 8*).—Cultural directions for growing kidney beans in the forcing house.

Tropical species of Mucunas and Dolichos, E. André (*Rev. Hort., 73 (1901), No. 3, pp. 61–63, figs. 5*).—The author states that these plants are the beans of warm countries. *Mucuna pruriens, M. nivea, M. gigantea, M. horrida, M. utilis, M. atropurpurea*, and *M. monosperma* are briefly characterized and *M. pruriens* and *M. nivea* illustrated.

The cultivation of Znaim cucumbers, J. G. Smith (*U. S. Dept. Agr., Section of Seed and Plant Introduction Circ. 2, pp. 4*).—Notes are given on the culture and cost of production of cucumbers at Znaim, Austria. The Znaim cucumbers are a variety of *Cucumis sativus*, and are extensively cultivated for export as pickles, salted, spiced, preserved in sugar, or flavored with mustard. The seed of this cucumber has been obtained for distribution among the agricultural stations of the country.

American ginseng, M. G. KAINS (*Amer. Gard., 22 (1901), No. 325, pp. 188, 189*).—Abstract of an address before the Horticultural Society of New York, March 13, 1901.

The best horse-radish varieties of Europe, and methods of cultivation, D. G. FAIRCHILD (*U. S. Dept. Agr., Section of Seed and Plant Introduction Cir. 1, pp. 8, figs. 4*).—Methods of growing Bayersdorf and Maliner Kren or Bohemian horse-radish are here described in detail and estimates given as to the cost of production and the profits in horse-radish growing.

Lettuce forcing, W. SCOTT (*Amer. Gard., 22 (1901), No. 324, p. 171*).—Methods based on experience. Grand Rapids has been found easiest to grow and least subject to disease of the open types, and Deacon has proven the most satisfactory of the head lettuces.

Prospects and present condition of agave culture in German East Africa, R. HINDORF (*Tropenpflanzer, 5 (1901), No. 1, pp. 7–17*).

The relation of growth to flowering in fruit trees, E. S. GOFF (*Amer. Gard., 22 (1901), No. 319, p. 75*).—The principles are laid down by the author that (1) there is an inverse relation between growth and flowering—the causes that promote growth being opposed to flowering and *vice versa;* (2) "that the amount of growth that takes place in any part of a plant depends upon the amount of water received by that part, and (3) that flower buds form freely only when they receive an abundance of light."

On fertilization of fruit trees, M. WEIBULL (*Landtmannen, 11 (1900), No. 21, pp. 338–343*).

Fruit culture for northern latitudes, J. H. HALE (*New Hampshire Bd. Agr. Rpt. 1899–1900, pp. XXI–XXXIX*).—Refers especially to New England and New England conditions.

New hardy fruits for Manitoba and the Northwest Territories, W. SAUNDERS (*Ontario Fruit Growers' Assoc., 1899, pp. 109–113*).—*Pyrus baccata* was crossed in 1894 with several varieties of hardy apples, such as Tetofsky, Wealthy, and Duchess. From the seeds obtained, seedlings were grown, five of which seem to be of much merit and are described. Crosses have also been made on *Pyrus prunifolia*, but no fruits have been obtained as yet.

Report of the fruit experiment stations of Ontario, L. WOOLVERTON ET AL. (*Ontario Fruit Expt. Stas. Rpt. 1899, pp. 68, figs. 38*).—Results are reported of cultural and variety tests of orchard and small fruits at 13 fruit experiment stations in Ontario. Descriptions and illustrations are also given in addition to those previously noted (E. S. R., 11, p. 547) of 5 varieties of apples, 9 of cherries, 2 of peaches, 4 of raspberries, 2 of pears, and 1 each of currants, grapes, and plums grown in Ontario.

The production of high-grade fruit, G. E. POWELL (*Ontario Fruit Growers' Assoc. Rpt. 1899, pp. 32–47*).—The author is meeting with success in topworking Northern Spy stock with scions from well-formed and bearing Kings. The method of orchard cultivation observed by the author is also described.

The effect of yearly pruning on the growth of orchard trees (*Ber. K. Lehranst. Obst, Wein u. Gartenbau, Geisenheim, 1899–1900, pp. 18–21*).—Numerous observations go to show that yearly pruning hinders the growth of the tree and greatly retards the blooming period.

The apple in West Virginia, L. P. MILLER (*West Virginia Farm Rev., 8 (1900), No. 12, pp. 396–399*).—The sorts and location for apple orchards in West Virginia are discussed. Freestone and soapstone highlands with trees 40 by 40 ft. apart are advocated.

Notes on some of the newer apples, G. B. BRACKETT (*Amer. Gard., 22 (1901), No. 325, pp. 190, 191*).—Historical and descriptive notes on York Imperial, Arkansas, Paragon Beach, Collins Red, Oliver, Reagan, Stayman Winesap, Grimes Golden, Jonathan, and White Pippin.

Newton Pippin hybrids in New York (*Amer. Gard., 22 (1901), No. 322, p. 134*).—Notes on Newton Pippin hybrid apples grown on selected seedlings from Newton Pippin crossed on Northern Spy, Rhode Island Greening, and Russets. The hybrids are believed to be very important additions to our list of apples.

International fruit exhibit at Paris (*Württemburg. Wchnbl. Landw., 1900, No. 47, p. 739*).—A comparison of American and German apples.

Mineral constituents of apples and pears, E. Hotter (*Ztschr. Landw. Versuchsw. Oesterr., 3 (1900), No. 5, pp. 583–585*).—A table is given showing the summarized ash analyses of the fresh and dry substance of several varieties of apples and pears.

The pear tree study of its method of fructification, C. Trébignaud (*Jardin, 14 (1901), No. 332, pp. 380–382, figs. 2*).—The variety Passe-Crassane was studied especially.

Essential principles of pear culture in the Hudson River Valley, J. R. Cornell (*Rural New Yorker, 60 (1901), No. 2667, p. 163*).—The author advises the use of only standard trees set 20 ft. apart each way. Phosphoric acid, potash, and crimson clover are the fertilizers used. The most desirable varieties are Elizabeth, Bartlett, Seckel, and Bosc, mentioned in the decreasing order of their importance.

Pruning in place of thinning (*Pacific Rural Press, 61 (1901), No. 9, p. 129*).—Spring pruning peaches after the fruit had set was compared with winter pruning and the fruits thinned by hand. The spring pruned peaches were larger than the winter pruned, and the conclusion is reached that spring pruning can replace winter pruning and thus save the cost of hand thinning.

Report of the horticulturist, H. H. Hume (*Florida Sta. Rpt. 1899 and 1900, pp. 25–30, figs. 3*).—A brief account of citrus experiments under way, pecan culture in Florida, and on 3 native plants for decorative purposes. Fifty navel and sweet oranges have been budded on 5 different kinds of stock, viz, pomelo, sour orange, rough lemon, sweet orange, and *trifoliata*, to determine to some extent the relative merits of these stocks. Descriptions and illustrations are given of the Atamasco lily (*Zephyranthes atamasco*), sparkleberry (*Vaccinum arboreum*), and sumac (*Rhus copallina*), native plants believed by the author to be of value for ornamental purposes.

Heating lemon orchards (*Tradesman, 44 (1901), No. 12, p. 62*).—This is an account of an experiment with artificial heat for preventing damage from frost in a large lemon orchard near Santa Paula in California. It is reported that by means of small coal fires in iron baskets placed at different points in the orchard the latter was protected from injury, although the normal temperature of the valley fell as low as 22° and heavy frost was formed in fields surrounding the orchard.

The artificial coloring of oranges, Pum and K. Micko (*Ztschr. Untersuch. Nahr. u. Genussmtl., 3 (1900), No. 11, pp. 729–735, pls. 2, fig. 1*).—From numerous experiments the author shows that the artificial production of blood oranges must be very limited. The chemical composition of the coloring matter of the juice of true blood oranges was also studied.

Report of the instructor in coffee culture, H. Newport (*Queensland Dept. Agr. Rpt. 1899–1900, pp. 38–41*).—A general discussion of coffee culture in Queensland.

Liberian coffee, its culture and preparation for market, V. Boutilly (*Le cafeier de Libéria, sa culture et sa manipulation. Paris: Callamel, 1900, pp. VII+140*).

American tea gardens, actual and possible, Lenora B. Ellis (*Amer. Mo. Rev. of Rev., 23 (1901), No. 3, pp. 315–320, figs. 8*).—The article is based on the results secured at Summerville in South Carolina on the Pinehurst estate, an account of which has been noted elsewhere (E. S. R., 11, p. 741).

The influence of copper compounds on the phenomena of ripening, Chuard and F. Forchet (*Rev. Vit., 14 (1900), p. 75; abs. in Ann. Agron., 26 (1900), No. 11, pp. 577, 578*).—Copper salts in solution were sprayed on currants to observe their effects on the ripening of the fruit. The copper treatment increased regularly, but only in a small way, the size of fruits and also their sugar content. This increase did not exceed 1 to 2 per cent.

Cost of growing cranberries, A. J. RIDER (*Proc. Amer. Cranberry Growers' Assoc., 1900, pp. 3-8*).—The cost of growing, harvesting, and marketing a bushel of cranberries is estimated at $1.55.

Strawberry culture, A. DESPEISSIS (*Agr. Jour. Cape Good Hope, 18 (1901), No. 2, pp. 74-90*).—Strawberry classification, mulching, propagation, picking, and packing, descriptions of varieties of different classes, and methods of protection against insects and diseases are discussed at length.

Report of strawberries on the strawberry valley farm for the summer of 1900, E. W. WOOSTER (*Amer. Gard., 22 (1901), No. 322, p. 129*).—This farm is located at South Hancock, Me. The season was dry. Clyde resisted drought well. Brandywine gave better results on plants of the second and third year fruiting. Hunn was the latest variety ever grown on the farm. Of the new berries Dewey outranked every other variety grown in desirable qualities. Hawaii was the earliest berry fruited, of excellent quality, and especially desirable for home use.

California raisin culture (*Sci. Amer., 84 (1901), No. 1, pp. 3, 8, figs. 8*).—Popular account of the industry.

Test of the Sutherland fruit preserving process, G. QUINN (*Rpt. Min. Agr., South Australia, 1900, p. 37*).—By this process the individual fruits (except grapes) are wrapped in tissue paper and packed in damp-proof waxed paper bags, which fit as a lining in the fruit cases. After the fruits are packed, the mouth of the bags is folded over and a hot iron passed along the folded edge. This melts the wax and seals the opening air-tight. The cases are then closed and placed in a temperature 1 or 2° above freezing. Tests are reported with pears, peaches, and grapes, but as there was only one check lot the test is considered incomplete. The check lot showed no disadvantage because of the omission of the waxed paper.

Home or farm canneries, D. S. HELVERN (*Missouri State Hort. Soc. Rpt. 1900, pp. 75-77*).—The author describes his small canning plant, which is proving a valuable adjunct to the farm.

The cactus and decorative dahlias, S. MOTTET (*Jardin, 14 (1901), No. 331, pp. 360-364, figs. 4*).—Notes on the different races and descriptions of varieties.

Subwatering carnations (*Florists' Exchange, 13 (1901), No. 10, pp. 243, 244*).—In a discussion of this subject at a meeting of the American Carnation Society, J. L. Dillon stated that he used solid beds made of 1 part Portland cement and 5 parts coal ashes. The beds were filled first with 3 in. of coarse screened ashes. On top of this was put 1 in. of fine ashes and then 4 in. of soil. Water was run into a round tile which connected with V-shaped tile running across and lengthwise of the bed. The beds were watered 4 or 5 times more quickly by this method than by surface watering, and about 25 per cent more and better flowers were obtained.

Hybridizing the carnation, P. FISHER (*Florists' Exchange, 13 (1901), No. 8, pp. 189, 190*).—Paper read by the author before the American Carnation Society at its Baltimore meeting, February 21, 22, 1901.

History of chrysanthemums, C. CHEVALIER (*Belg. Hort. et Agr., 12 (1900), No. 23, pp. 354, 355; 13 (1901), No. 1, pp. 6, 7*).—Historical notes on the chrysanthemum in Europe.

New researches on Persian lilacs and their crosses, L. HENRY (*Rev. Hort., 73 (1901), Nos. 2, pp. 39-42, figs. 3; 3, pp. 60-72, figs. 6; 4, pp. 93-95, figs. 3*).—Largely of a historical nature.

The newer roses, E. G. HILL (*Florists' Exchange, 13 (1901), No. 11, pp. 264, 265*).—Paper on the subject read by the author before the New York Florists' Club, March 11, 1901.

The question of color relative to flowers, F. S. MATHEWS (*Florists' Exchange, 13 (1901), Nos. 5, p. 110, figs. 4; 10, Sup.*).—The author presents a scheme for the scientific building up of a nomenclature for colors in flowers founded on the simple range of the prism.

FORESTRY.

Experiments in replanting cut-over pine lands, H. H. CHAPMAN (*Farm Students' Rev., 6 (1901), No. 1, pp. 6, 7*).—An account is given of cooperative experiments with the Division of Forestry of this Department, in which pine seedlings were transplanted in the spring of 1900 on cut-over pine lands at the Northeast Experiment Station of Minnesota. White and Norway pines were the principal varieties used. Different distances of planting were compared, and also the effect of alternating the varieties in rows and planting alternated rows of jack pine. The pines were dug from the nursery rows, covered with dirt until loaded into the wagons, and the whole mass wet by throwing water over it. The planting was commenced as soon as the ground had thawed to a spade's depth. The first plantings were made by cutting the turf on each side with a spade, turning up the turf and soil and inserting the roots of the plant, no particular effort being made to separate or arrange them. Later, when the ground became drier, the top layer of roots and sod was turned back and a spadeful of dirt from below was placed over the roots before the sod was replaced. A dry season followed, and, contrary to expectations, the loss was less than 5 per cent. In all more than 13,000 trees were planted at a cost ranging from $2 to $11 per acre, dependent upon the distance planted. The trees at the time of planting were rather large for pine seedlings, and the cost is considered rather more than the average cost of planting on a large scale.

Norway spruce for profit on the plains, H. B. KEMPTON (*Forester, 6 (1900), No. 12, pp. 295, 296*).—The Norway spruce, which is comparatively well known in the eastern United States, is said to have been planted but little upon the plains. It has been sufficiently introduced, however, to show its adaptability over a wide range of that country. It seems probable that it is adapted to a large part of Iowa, Nebraska, Kansas, and other central western States. An account is given of the planting made at Conroy, Iowa, 18 years ago. The seedlings were secured at Mount Carroll, Ill., and packed closely in wet sphagnum moss. When received they were still moist, and were set in nursery rows. For several years they were screened by a partial shade of lath, after which they were transplanted in 12-ft. rows set 4 ft. apart in the row, and were interplanted with corn. Not less than 95 per cent of the seedlings are alive at the present time and in good condition. Growing nearby are plantations similarly managed of green and white ash, box elder, soft maple, honey locust, red cedar, white and Scotch pine; and under the conditions existing the Norway spruce has made more rapid growth than any of the other trees. The growth of the Norway spruce trees on this plantation has averaged 1 ft. 9 in. for the past 15 years, the present height being 29 ft., with

an average diameter of 4.7 in. In 10 years from now it is calculated that the poles will be worth $258.16 more than would have been secured from the market price of corn cultivated for the same time on the same area.

Additional notes on tree measurements, C. E. HALL (*Trans. and Proc. Bot. Soc. Edinburgh, 21 (1900), pt. 4, pp. 243-258*).—In the transactions of this society for 1890 (vol. 18, p. 456), the author reported upon the rate of growth of a number of trees from measurements made at San Jorge, Uruguay. Monthly measurements of these trees have been made from January, 1885, to January, 1900. Sixteen trees were measured—2 eucalyptus, 2 stone pine, 2 blackwood (*Acacia melanoxylon*), 2 oaks, 3 *Melia azedarach*, 2 Lombardy poplars, 1 robinia, 1 maple, and 1 cottonwood. The increments in tree growths are shown in tabular form and comments given upon the causes of the variation in some specimens. The growth of the trees during the period between 1890 and 1899 is shown in the following table:

Growth of trees during nine years at San Jorge, Uruguay.

Kind of tree.	Circumference of tree.		Increased growth of tree.	
	January, 1890.	January, 1899.	Total.	Annual.
	Mm.	*Mm.*	*Mm.*	*Mm.*
Eucalyptus sp	774	1,746	972	108
Do	725	1,491	766	85
Pinus pinea	1,141	1,559	418	46
Do	980	1,467	487	54
Acacia melanoxylon	727	932	205	23
Do	989	1,460	471	54
Melia azedarach	609	792	183	20
Do	602	768	166	18
Do	1,446	1,632	186	21
Quercus robur (?)	492	872	380	44
Do	572	814	242	27
Populus fastigiata	809	1,008	199	22
Do	704	865	161	18
Populus angulata	755	1,375	620	67
Robinia pseudacacia	433	536	103	11
Acer pseudoplatanus	670	1,055	385	43

The author also shows the monthly rate of growth, from which the effect of growing season and dormant period may be seen.

Forest planting, W. GILL (*Agr. Gaz. New South Wales, 11 (1900), No. 12, pp. 1130-1132, figs. 7*).—The 2 methods by which young trees are planted in South Australia are termed the "open root" and "bamboo tube" systems. The open root system consists of growing the trees in the open ground in nurseries, from which they are transplanted by the usual method. Unless the young trees are carefully protected, to prevent the drying out of the roots, many failures in planting will result. The bamboo tube system, which consists of growing the plants in small sections of the bamboo and setting them out in this way, is in many respects preferable. This method is practiced very largely in the propagation of gum trees, it having been found by far the best and most economical, as well as proving safer so far as root exposure is concerned.

Eucalypts, A. J. McClatchie (*Arizona Sta. Rpt. 1900, pp. 165, 166*).—A report is given of the experiments which have been conducted with the different species of Eucalyptus at the Arizona Station. Of a large number of species that have been tested many have been found to have been unable to withstand the summer temperatures of that region. Others have been found exceedingly valuable for planting and some of these are rated among the most valuable species of the genus. The species which have survived the heat and dryness of the Territory are *Eucalyptus corynocalyx*, *E. cornuta*, *E. hemiphloia*, *E. leucoxylon*, *E. melliodora*, *E. occidentalis*, *E. polyanthema*, *E. rostrata*, *E. rudis*, and *E. tereticornis*.

The Carolina poplar, J. T. Rothrock (*Forest Leaves, 7 (1900), No. 12, pp. 184, 185, pls. 2*).—A description is given of the Carolina poplar or cottonwood (*Populus monilifera*). This tree frequently attains the height of 100 ft., with a diameter of 7 or 8 ft. The tree is described at some length, and on account of its rapid growth and adaptation to all kinds of soils is said to be a promising one for forest culture. The wood is brittle, liable to split and warp, but is valuable for the production of wood pulp. On this account it is likely to exceed other native trees for such purposes. An account is given of a planting made in 1899 of 1,000 cuttings of the Carolina poplar which, without any protection during the winter or especial preparation when planting, presented 75 per cent of the plants making satisfactory growth the following year.

SEEDS—WEEDS.

The protein substances of seeds, T. Bokorny (*Bot. Centbl., 82 (1900), No. 10–11, pp. 289–306*).—The present state of our knowledge of the protein substances of seeds is summarized by the author, in which it appears that globulins soluble in 5 to 10 per cent solution of sodium chlorid are stored up in the protein grains and albumin crystals of seeds. The protein or aleurone grains vary in size from 1 to 55μ, their largest size being obtained in oily seeds. In the endosperm of cereals they are said to be very small but never entirely absent. The presence of active protein could not be detected in grains. The fibrin of cereals is said to be peculiar in that it is soluble in 70 to 80 per cent cold or hot alcohol, a reagent which precipitates the other protein substances. The author was unable to detect any peptone in dormant seeds, while albumoses were occasionally found in minute quantities. Amid substances, such as asparagin, tyrosin, and leucin, are widely distributed in seeds and the vegetative parts of plants. The author states they appear to be the first products of decomposition and the first stage in the formation of protein substances.

The influence of the sun's rays upon the germination of seeds, T. Tammes (*Landw. Jahrb., 19 (1900), No. 3, pp. 467–482, pl. 1*).—The effect of the sun's rays upon the germination of sunflowers, horse beans, centaury, rice, *Allium fistulosum*, *Erodium cicutarium*, and *Nicotiana rustica* is shown. The experiments were conducted with specially devised apparatus in which comparisons could be made of seeds germinated under identical conditions except as to illumination. One lot was germinated entirely in the dark, another received direct sunlight for 44 days, while the control lot was germinated out of the

direct rays of the sun. In nearly every instance those seeds which were subjected to the direct sun's rays were retarded in their germination, although the effect upon the total germinative ability was not influenced in any appreciable degree, the total number of germinations in each lot being practically the same.

On the germination of tobacco seed, M. RACIBORSKI (*'S Lands Plantentuin. Bul. Inst. Bot. Buitenzorg, 1900, No. 6, pp. 10*).—The wide variation presented by the germination in different lots of tobacco seed, when tested under varying conditions, led the author to investigate some of its causes. Similar lots of seed were germinated under identical conditions except that one lot was kept in total darkness and the other in diffused daylight. The seed placed in the light germinated rapidly and well, while those kept in the dark, although the investigations were continued for 40 days, in some cases did not show a single germination. Submitting the latter to the light for a few hours, however, was sufficient to stimulate the seed to germination. Tobacco seed sown upon soil, sand, peat, etc., and kept in the dark, failed to germinate.

The effect of age on seed was investigated, with the result that 1-year-old seed germinated 96 per cent, 2-year-old 85 per cent, and 4-year-old 66 per cent. The variation due to variety was tested, in which it was found that tobacco seed varied from 1 to 10 per cent in different varieties when germinated under identical conditions. Notes are given on some of the physiological phenomena during germination, and chemical studies on the differences between the roots and the stems of the young plantlets.

Germination of wheat and oats treated for smut (*Wyoming Sta. Rpt. 1900, pp. 3*).—A report is given of the effect on germination of treating wheat and oats with solutions of copper sulphate, potassium sulphid, and by the Jensen hot-water treatment. The copper sulphate solution was made by dissolving 1 lb. of commercial copper sulphate in 24 gals. of water. In these the seed were soaked 13 hours, after which they were removed and immersed in limewater for 5 minutes. The potassium sulphid treatment consisted of soaking the seed for 2 hours in a 2 per cent solution of that substance. The hot-water treatment consisted of subjecting the seed grain to a temperature of 135° F. for 15 minutes. The results of the germination test showed that in every case the treatment proved injurious to the seed. As a possible explanation of this fact it is suggested that the seed coats of the grain, nearly all the specimens of which had been grown at Laramie in 1899, may have been much thinner than usual, thus not offering the protection usually given to such seeds.

Combating weeds by means of metallic salts, FRANK (*Arb. K. Gesundheitsamte, Biol. Abt., 1 (1900), No. 2, pp. 127–175, pl. 1*).—A review is given of some of the literature relating to the destruction of

weeds by chemical means, and a detailed description of the author's experiments made in 1899 to determine the best chemicals and the quantities required for their destruction. The method of application, whether in the form of a solution or powder, was also investigated. From the results of his experiments the author states that iron sulphate in 15 per cent solutions, at the rate of 500 liters per hectare, gave the most satisfactory results, when cost of materials and efficiency were considered. Copper sulphate in a 5 per cent solution, at the same rate, was equally efficient, but was more expensive. The method of application showed decidedly in favor of spraying with solutions. In addition to the effect of the solutions upon the weeds, the amount of injury to crops in which the weeds were growing was noted and reported. The crops sprayed with the herbicides were oats, barley, wheat, rye, red clover, peas, vetches, potatoes, and sugar beets.

The author sums up his observations with the statement that spraying with metallic salt solutions must not be considered as a universal means for weed destruction. The solutions killed wild mustard and wild radish, and seriously injured curly dock, black bindweed, dandelion, sow thistle, and senecio, but had little or no effect on the poppies, chenopodiums, euphorbias, cornflower, field thistle, chamomile, bindweed, couch grass, bent grass, or equisetums. Little or no injury to field crops was observed when the solutions were sprayed over cereals, red clover, or sugar beets, the plants readily recovering from the slight injury inflicted. Field peas were considerably affected, and vetches and potatoes badly injured. The best time to spray for the destruction of charlock and mustard is when the plants are from 4 to 7 cm. high, or about the time the plants have 3 or 4 leaves, and before they begin to flower.

Red clover seed, A. J. Pieters (*U. S. Dept. Agr., Farmers' Bul. 123, pp. 11, figs. 2*).—Red clover seed and its more common adulterants and mixtures are described and notes are given showing the results of tests made of different samples of clover seed. The pure and germinable seed in the samples ranged from 53.26 per cent to 95.8 per cent. The calculated price of the different lots reported upon varied from $4.74 to $9.00 per bushel. Field tests of a number of American and European clovers are briefly reported upon. Thirty-five samples of European and American clovers were sown in plats 1 rod square. The sowings were made the latter part of April and the condition of the plants throughout the season is indicated. At the end of June the average condition of the European plats was slightly better than that of the American, but from that time on there was a decided change to the advantage of the American grown seed. The effect of the summer heat was very injurious to the European varieties. In July and September all the plats were mown, the green fodder weighed and the amount calculated per acre. The average yield of green clover for the season, from the American seed, was 12,704 lbs., and the European 7,792 lbs.

Report of seed testing, Baessler (*Ber. Agr. Chem., Vers. u. Samencontrol Sta., 1900, pp. 14–16*).—A report is given upon the testing of 1,085 samples of seeds, an increase of nearly 50 per cent over the previous year. Especial attention was given the presence of dodder seeds in clover and grass seeds. Dodder seed was found in

more than half the samples of red clover, alsike clover, white clover, alfalfa, and timothy. The average purity of all samples examined showed a depreciation of 0.5 per cent from that of the previous year.

Potassium perchlorate poisoning and its prevention, J. R. JUNGNER (*Deut. Landw. Presse, 27 (1900), No. 62, p. 771, figs. 2*).—Germination experiments to study the physiological effects of the perchlorate are reported.

The weeds of Ontario, F. C. HARRISON (*Bul. Ontario Dept. Agr., 1900, Mar., pp. 80, figs. 34*).—Popular notes are given on the introduction and spread of weeds, means for their identification, and suggestions for eradication. A number of the more common weeds are figured and described, and specific directions for their eradication are given so far as possible.

Destruction of mustard with ammonium sulphate, G. CASTEL-DELÉTREZ (*Jour. Roy. Agr. Soc. L'Est Belg., 1900, p. 112*).

The destruction of certain weeds, as ground ivy, mustard, and thistles, by spraying with a solution of metallic salts (*Deut. Landw. Presse, 27 (1900), No. 27, pp. 327–329, figs. 6*).

The eradication of lantana (*Indian Forester, 27 (1901), No. 1, pp. 28–33*).—Lantana is said to have been introduced into India as a hedge plant some 40 years ago, and it has spread widely, until in some districts it has become a very serious pest. An account is given of various experiments conducted for its eradication. In Ceylon it was found that lantana which had thickly occupied the ground for 12 or more years, could be cleared by contract at the rate of about $7.50 per acre, the plants being uprooted and burned. Detailed accounts are given of experiments in eradication in a number of parts of India, from which it appears that dense growths of this pest may be eradicated at a cost of about $7.50 per acre, which includes the original clearing and 3 seasons of subsequent work.

DISEASES OF PLANTS.

A preliminary bulletin on the prevention of smut on oats, E. F. PERNOT (*Oregon Sta. Bul. 63, pp. 9*). A preliminary report is given of a series of experiments to prevent the smut on oats, in which seed were treated with solutions of copper sulphate and zinc sulphate, hot water, formalin, and sterilized dry hot air at a temperature of 200° F. for 10 minutes. After treatment the seeds were sown, and at harvest all the oat heads which showed any signs of smut were carefully removed and counted. The least smut was found on the plats the seed of which had been treated with hot water and hot air, the greatest amount of smut occurring on those plats which had received the formalin treatment in which two different strengths of solution were used. The effect of treating oats for 10 minutes at different temperatures of hot air, from 132 to 200°, were tested, in which it was found that none of the treatments seriously affected the germination of the seed. On account of the convenience of handling the oats, the author is disposed to recommend the dry hot air sterilization for smut prevention. An extensive experiment with different seed grains is to be conducted, in which the value of hot air as a preventive of smut is to be further investigated.

Investigations on a leaf curl of mulberry trees, M. Miyoshi (*Bot. Centbl., 83 (1900), No. 11, pp. 346, 347*). This disease, which seriously threatens the mulberry trees of Japan, is characterized by a marked increase in the number of lateral twigs and leaves through the development of adventitious buds. At the same time the development of the leaves becomes abnormal. They are greatly reduced in size, crumpled with a less developed mesophyll, while upon the upper side numerous blister-like elevations occur between the veins. The leaves become yellowish in color and hard in texture, and the twigs are but little developed. In the older branches, where the disease has been severe, leaf and twig growth is stopped and the whole branch ultimately falls to the ground.

The cause of this disease is believed to be not parasitic, but is due rather to the impaired functions of the twigs and leaves, brought about by the common practice of removing them for silkworm feeding.

The "mal nero" of grapes, D. Cavazza (*Vigne Amer., 24 (1900), Nos. 5, pp. 155-157; 6, pp. 182-186*).—This grape disease, which the author says is also known as "bacterial gummosis," the California vine disease, gélivure, chytridiose, etc., is said to be a very polymorphous disease caused by *Bacillus vitivorus*. It attacks all parts of the plant, producing variable symptoms which seem to be somewhat dependent upon external conditions. The season, time of appearance, and development of the parts attacked influence the color of the diseased leaves, making them yellow, red, reddish brown and violet, etc., as the case may be. The bacillus attacks the cambium and extends into the wood of the vine, producing irregularly triangular brown spots. As means for the partial prevention of the disease, which the author believes attacks the plants from the soil, the fumigation of the soil with carbon bisulphid and thorough drainage are recommended.

Copper sulphate as a remedy for grape mildew (*Sci. Amer. Sup., 49 (1900) No. 1266, p. 20301*).—A report is given of investigations with copper sulphate for the prevention of grape mildew. On account of the solubility of this substance it is claimed that it does not adhere readily to the foliage, and numerous attempts have been made to secure a more adhesive as well as cheaper mixture. The results of some investigations by Trabut are given, in which the dry resin exuded from pines in Algeria, as well as the mucilage which is extracted from the stems of the Barbary fig tree, were used with excellent results. The resin mixtures were prepared by heating 1 kg. with 500 gm. of soda or potassium carbonate. To this was added 500 gm. copper sulphate and 100 liters of water. A second preparation was obtained by extracting by maceration the mucilage from 3 to 5 kg. of the Barbary fig tree and adding simple solution of copper sulphate. By the use of either of these fungicides it is claimed that from 50 to 80 per cent of the copper sulphate is saved and the prevention of the mildew secured.

A sclerotioid disease of beech roots, H. VON SCHRENK (*Rpt. Missouri Bot. Gard., 10 (1899), pp. 61-70, pls. 2*).—The author reports having found a large number of small tubercles attached to the fibrous roots of beech trees. The tubercles were of various sizes and shapes, some almost round, others elliptical and varying in size from about as large as a small pea to some scarcely visible to the naked eye. Upon examination of the tubercles they were found to consist of a bundle of cylindrical bodies which intertwined. Each was covered and held firmly in place by a membrane or sheath. The main body of the tubercle consisted of a large number of small rootlets, each twisted and contorted and held in place by the fine hyphae. The cause of the formation of these structures is attributed to the stimulus brought about by some fungus. No evidence of parasitism was observed, the hyphae simply surrounding the roots without entering the cells. The presence of a large number of small sclerotia, together with the tubercles, suggests that the sterile mycelium of the tubercles probably belongs to some Hymenomycete which usually forms sclerotia.

Chrysanthemum rust, J. C. ARTHUR (*Indiana Sta. Bul. 85, pp. 143-150*).—The occurrence of rust on chrysanthemums was observed in the fall of 1899 in Indiana. It is easily distinguished from all other diseases that attack the chrysanthemum, as it forms small blisters about the size of a pin head, appearing on the under surface of the leaf. These soon break open and expose a dark brown powder, the uredospores. These blisters by coalescing frequently become of considerable size and are occasionally found upon the upper surface of the leaves. An experimental study was made by the author to infect a number of related species with the uredospores of this fungus, but it was found to grow only upon the true chrysanthemum. The fungus, which is known as *Puccinia chrysanthemi*, appears to be a native of Japan introduced into Europe and America through commercial agencies. Thus far no teleutospores have been found and on this account the disease would probably be of easy control. Picking off the diseased leaves and the total destruction of badly diseased plants, together with spraying with Bordeaux mixture or potassium sulphid will doubtless keep the disease in check.

Concerning the rust fungus on chrysanthemums, P. MAGNUS (*Gartenflora, 49 (1900), No. 11, pp. 294-296*).—The specific causes of the rust growing on *Chrysanthemum indicum* have been examined by a number of individuals and their determinations are given. According to Massee, the fungus is *Puccinia hieracii*. Subsequently, the rusts on chrysanthemums have been investigated by Rozé, who finds them due to different causes, one of which is designated as *Uredo chrysanthemi*. For this form, spraying with Bordeaux mixture seems to have had no effect in preventing diseases. In a later publication, Rozé describes *Puccinia chrysanthemi*, which he says is the cause of the rust on chrysanthemums.

An anthracnose and a stem rot of the cultivated snapdragon, F. C. STEWART (*New York State Sta. Bul. 179, pp. 105–111, pls. 3*).—In 1897 the author's attention was called to an anthracnose of snapdragons occurring in a greenhouse on Long Island, and upon inquiry he learned that it was a rather common disease, being the most destructive of the diseases to which this plant is subject. It attacks the plants at any stage of their growth, in the greenhouse and in the field. In the greenhouse it is most destructive in the fall and spring, while in the fields its ravages are most conspicuous during August and September.

It attacks the stems and leaves of the plants. Upon the stem it produces elliptical sunken spots 3 to 10 mm. in length. Upon the leaves the spots are circular, and have a diameter of from 3 to 5 mm.

The cause of this disease is said to be *Colletotrichum antirrhini*, n. sp., which is described. An experiment was undertaken for the prevention of the disease, in which plants were sprayed once a week with Bordeaux mixture, receiving during the course of the summer 17 applications. In August the contrast between the sprayed and unsprayed plants was very striking, and in September the unsprayed plants were completely ruined while the sprayed ones were in perfect health. As recommendations for treatment the author suggests that cuttings should be made from healthy plants only, and where the disease is troublesome spraying with Bordeaux mixture, beginning as soon as the cuttings are rooted and continuing until the plants are transplanted in the fall. So far as known at present, this anthracnose attacks no other plant, and growers whose grounds are free from the disease will have no trouble so long as they propagate from their own stock or seed.

The stem rot described was first observed in December, 1898. It attacks chiefly the succulent shoots, causing several inches of the terminal portion to wilt and die. In some cases, especially where the shoots have become somewhat woody, a section of the stem turns brown while the portion beyond remains green. In a short time the whole branch dies.

This disease is attributed to the attack of a species of Phoma. Inoculation experiments showed that the disease was readily communicated, shoots which were inoculated generally dying in from 4 to 10 days. The species of the fungus has not yet been determined, and from the nature of the attack it is thought that the disease could probably be controlled by spraying with Bordeaux mixture, as suggested for the anthracnose.

Report of the department of botany, A. A. TYLER (*Arizona Sta. Rpt. 1900, pp. 167–170*).—A brief account is given of the investigations which have been conducted at the station on the crown gall, the detailed report on which is given in Bulletin 33 (E. S. R., 12, p. 458). Experiments have been continued on alfalfa root rot, in which plats have been laid off, divided into equal portions, and treated with

a number of fungicides, such as copperas, Bordeaux mixture, ammoniacal copper carbonate, corrosive sublimate, sodium carbonate, and creolin. The effect of digging trenches around infested areas has also been the subject of examination, and the resistance of different varieties of alfalfa is being studied. A report on these studies is to be expected in the future. Notes are given on the collection of economic cacti at the station, and attention is called to the prevalence of the sorghum smut in different parts of the Territory. For the prevention of this disease, the author recommends the Jensen hot-water treatment.

The rust of flax, L. Marmier (*Misc. Biol. ded. au A. Giard, Paris, 1899, p. 440; abs. in Centbl. Bakt. u. Par., 2. Abt., 6 (1900), No. 17, p. 568*).—The so-called rust of flax is said to be due to an anaerobic bacillus. The pectose of the cell membrane is said to be changed to calcium pectate under the influence of the organism.

Wheat diseases, R. Helms (*Jour. Dept., Agr. West. Australia, 1900, Feb., pp. 22-32, figs. 3*).

Some experiments in dealing with bunt, or the stinking smut of wheat, W. Farrer (*Agr. Gaz. New South Wales, 11 (1900), No. 5, pp. 335-344*).

Diseases of the sugar cane (*Prog. Mexico, 7 (1900), No. 321, pp. 517-520*).

A turnip disease, W. Carruthers (*Jour. Hort., 52 (1900), No. 2711, p. 244*).—A brief note is given on a disease of turnips and swedes that is due to bacteria.

The rusts of horticultural plants, B. D. Halsted (*Trans. Massachusetts Hort. Soc. 1900, I, pp. 11-29, pls. 2*).—A lecture in which a number of common rusts are described and preventive treatments recommended.

Diseases of celery, H. H. Hume (*Florida Sta. Rpt. 1899 and 1900, pp. 34-37, pls. 2*).—A popular description is given of the celery blight (*Cercospora apii*), center blight which is probably of bacterial origin, and the leaf spot (*Septoria petroselini apii*), together with remedies suggested for their repression.

Fungus diseases of cucumbers, tomatoes, and lettuce under glass, G. E. Stone (*Trans. Massachusetts Hort. Soc., 1900, I, pp. 117-126*).—A lecture in which the diseases of these plants when grown under glass are described.

Downy mildew of the cucumber, H. H. Hume (*Florida Sta. Rpt. 1899 and 1900, pp. 30-34, pl. 1*).—The downy mildew of the cucumber (*Plasmopara cubensis*) is described and its occurrence in the United States is historically reviewed. The characteristics of the disease are shown, and it is stated that in Florida the fungus lives and thrives throughout the entire year, so that the formation of resting spores is not essential. A brief account is given of experiments conducted for the repression of this disease, in which the plants were sprayed with Bordeaux mixture. Rainy weather followed the application of the fungicide, the rainfall being so heavy as to destroy many of the plants, but upon those surviving the effect of the spraying was quite marked.

Yellows in peach trees (*Gard. Illus., 22 (1900), No. 1138, p. 573*).—Suggestions are given as to increasing the vigor of trees so as to prevent peach yellows.

Wart-like outgrowths on Pirus malus chinensis, N. W. Kissa (*Ztschr. Pflanzenkrank., 10 (1900), No. 3-4, pp. 129-132, pls. 2*).—The occurrence of peculiar outgrowths is mentioned and their anatomical structure described. They are believed to be of little injury to the plants bearing them, aside from the material required for their formation and their disfiguring the host. They are rather small and have somewhat the appearance of clusters of buds.

The treatment of the fumagine of grapes, L. Degrully (*Prog. Agr. et Vit. (Éd. L'Est), 22 (1901), No. 3, p. 67*).—Notes are given on this disease, and the treatment previously recommended (E. S. R., 12, p. 61) is again advised.

A disease of grapes in the Caucasus, L. Montemartini and L. Farneti (*Extr. Atti R. Inst. Bot. Univ. Pavia, n. ser., 7 (1900), pp. 14, pl. 1*).—*Physalospora woronini*, n. sp., is described.

The biology and practical prevention of the leaf rust of white pine, C. von Tubeuf (*Abr. K. Gesundheitsamte, Biol. Abt., Leaflet 5, pp. 4, figs. 3*).

A new parasite of Caragana, A. de Jaczewski (*Rev. Mycol., 22 (1900), No. 87, pp. 79–82, pl. 1*).—A description is given of *Pleospora caraganæ*, n. sp., found parasitic on the leaves of *Caragana arborescens* in Russia. A list of other fungi occurring on the leaves, branches, and trunk of this tree is given.

A new disease of Solomon's seal, A. de Jaczewski (*Rev. Mycol., 22 (1900), No. 87, pp. 78, 79*).—The author describes *Cylindrosporium komarowi*, n. sp., as parasitic on the leaves of *Polygonatum humilis.*

A new species of Exobasidium, Boudier (*Bul. Soc. Mycol. France, 16 (1900), No. 1, pp. 15–17, pl. 1*).—A description is given of *Exobasidium brevieri*, n. sp., parasitic on *Asplenium filix-femina*. It is closely related to *E. graminicolum*, a common parasite on the leaves of various grasses.

Parasitic algæ and fungi of Java, M. Raciborski (*II and III, pp. 46 and 49; abs. in Bot. Centbl., 84 (1900), No. 10, pp. 316–319*).—About 110 species are described, of which 88 are new species and 11 new genera.

Notes on the temporary injury due to copper fungicides (*Ztschr. Pflanzenkrank., 10 (1900), No. 5, pp. 311, 312*).—The leaves of a number of varieties of apple trees are said to have been temporarily injured by spraying with Bordeaux mixture.

Concerning copper soda and the use of greater or less amounts of copper sulphate in combating leaf diseases, J. Nessler (*Wchnbl. Landw. Ver. Baden, 1900, No. 11, pp. 145, 146*).

ENTOMOLOGY.

Report of the entomologist, H. A. Gossard (*Florida Sta. Rpt. 1899 and 1900, pp. 53–75, pl. 1, figs. 5*).—The West India peach scale (*Diaspis amygdali*) is reported as having been unusually injurious during the past season. A brief account is given of its distribution according to the present knowledge of the subject, and the use of mechanical mixtures of kerosene and water are recommended in combating it.

The San José scale has been found in 13 counties of the State. This insect was attacked by a fungus disease, *Sphærostilbe coccophila*. This fungus has been sent to other States by special request. During the year experiments were made with crude oil and kerosene in combating the San José scale upon peach, pear, and plum trees. On the 25th of January undiluted crude petroleum was applied with an emulsion nozzle to pear trees which were badly infested. All scales were apparently killed, but a part of the trees subsequently died of fire blight, so that it was impossible to determine what the effect of the petroleum was upon the trees. A number of plum trees were sprayed on the same day with undiluted petroleum. A greater number of the sprayed trees died than of those in the check row and were more injuriously affected than trees in adjoining rows that were sprayed with a 30 per cent mechanical mixture of crude oil and water. Experiments with undiluted crude oil on peach trees indicated that it is unsafe in Florida to apply this remedy to peach trees. The author concludes that great care should be exercised in the use of undiluted crude oil, and recommends that it should preferably be diluted before using.

The white fly (*Aleurodes citri*) was unusually injurious during the past year. The author recommended the use of resin wash to the fruit growers and received favorable reports concerning its effectiveness.

A number of experiments in fumigating with hydrocyanic-acid gas indicated that the white fly, red spider, and other insects were successfully killed by this method, but the author believes that the heavy dews of Florida will render the fumigation method more difficult than in California.

The cottony cushion scale is reported as having been preyed upon extensively by the caterpillar of *Lætilia coccidivora*. The scale was nearly exterminated by the agency of this caterpillar in some localities. A fungus disease was observed to cause the destruction of about 95 per cent of the scales in a few localities. The fungus parasite has not been studied and its relationship is not understood.

Attempts which were made in colonizing the Australian lady bug were without marked success. Brief notes are also presented on a number of scale insects and upon the pickle worm, melon borer, cucumber beetle, bollworm, and other injurious insects.

Report of the Illinois State entomologist concerning operations under the horticultural inspection act, S. A. FORBES (*Springfield, Illinois: Phillips Bros., 1900, pp. 30*).—The duties of the entomologist as prescribed under the horticultural inspection act fall under the two heads of nursery inspection and insecticide treatment of orchards and other property. During the first annual inspection the State was divided into 4 districts and an inspector was assigned to each district. The total number of premises inspected during the first year was 275. In only one case was a certificate refused to the owner of a nursery, and this was on account of San José scale being found on the trees left over from the sales of preceding years. The salaries and expenses of inspectors are charged against the nurserymen who receive their services. The average charge for the first year's work was $5.77, and for the second year's work, $3.74.

The woolly aphis was found in considerable numbers in 61 of the nurseries which were inspected. Brief notes are given on the root rot of apple and on the peach-tree borer. The disease known as crown gall was found in 52 nurseries. San José scale has been detected in 6 nurseries within the limits of the State, but has subsequently been exterminated in all except one. The number of localities in the State at which San José scale has been found amounts to 44, but the scale was subsequently exterminated in 10 of these places. In the majority of cases specimens which were sent in under the suspicion of being the San José scale proved to be the scurfy scale. Insecticide treatments against the San José scale include spraying with whale-oil soap, 2 lbs. to the gallon of water, kerosene in a mechanical mixture with water, and fumigation with hydrocyanic-acid gas. The kerosene emulsion was diluted so as to contain 17 per cent of the oil. The general

results of insecticide treatment discourage any hope of exterminating the scale by a single application. Brief notes are also added on the cankerworm and peach yellows.

As the result of the horticultural law, an annual inspection of nursery stock has been carried out, from which a rapid improvement in the condition of Illinois nurseries is evident. The San José scale has been detected in 6 nurseries and has been apparently exterminated in 5 of these. The annual inspection of orchards has resulted in the early discovery of the San José scale in many localities and the prevention of its distribution to a large extent. The author believes that the general operations of the law are beneficial.

Report of injurious insects and common farm pests during the year 1899, with methods of prevention and remedy, E. A. Ormerod (*London: Simpkin, Marshall, Hamilton, Kent & Co., 1900, pp. 152, figs. 28*).—The cabbage butterflies (*Pieris brassicæ*, *P. rapæ*, and *P. napi*) are discussed, brief notes being given for distinguishing the 3 species. An experiment was tried in dusting cabbages with a mixture of lime and soot. This application seemed to be useless. Another experiment was tried in spraying cabbage plants with Little's Antipest. This remedy seemed to be effective, and it is stated by the author that it may be used as a substitute for kerosene emulsion. A report is made by W. Bailey on the result of allowing two small boys to catch cabbage butterflies with nets during the noon hour for 7 days. They captured 834 butterflies, and it was noted that this had a striking effect in diminishing the number of caterpillars.

The habits, life history, and remedies to be used against *Piophila casei* are given, and detailed reports presented from a number of persons who suffered loss from the attacks of this insect upon ham, bacon, or cheese. As remedies, the author recommends the careful screening of all doors and windows, thorough fumigation in early spring or whitewashing with an addition of carbolic acid, careful cleaning of shelves and the use of live steam where possible for disinfecting such places, inclosing cheese in calico caps to prevent the attacks of the flies, the use of strong bags about ham and bacon, and cutting out portions of cheese and ham that are found to be already infested by the insect.

Clover weevils are discussed, the following species receiving consideration: *Apion apricans*, *A. assimile*, and *A. trifolii*. A detailed description of the larvæ and pupæ of *A. apricans* is given. As remedies against this insect, the author suggests early cutting or feeding of the crop before the heads of clover are in condition to give shelter to the weevils for egg laying. In cases of unusually serious outbreaks of this insect, spraying with Paris green or kerosene emulsion is recommended.

Notes are given on certain insects affecting grasses and cereals. Three species of crane flies (*Tipula oleracea*, *T. maculosa*, and *Pachyrhina maculosa*) are mentioned as especially injurious to meadows and pastures. Applications of guano alone, or mixed with salt, kainit, and superphosphate, have been found to assist the infested plants to outgrow the attacks of these insects. Applications to the soil of nitrate of soda and gas lime are also recommended. Salt applied alone failed to be of service in many cases, but as a preventive dressing before plowing was found to be of value.

Notes are given on the habits and life history of the Hessian fly, together with an account of its destructiveness in various parts of England. For the purpose of preventing injuries from this insect, the author recommends sowing wheat after danger of infestation from the Hessian fly is past, and the burning of infested chaff and screenings.

The enemies of the currant received consideration. *Phytoptus ribis* was carefully studied with reference to determining the means of distribution of this insect. A number of experiments conducted by the author and her correspondents indicate that the soil about the roots of infested plants does not contain the mite. The exact manner in which this mite extends its distribution is not known. The only practicable remedy suggested is the breaking off and destruction of infested buds. *Cidaria dotata* is described and figured, with a brief account of its injurious attacks upon red currants. As remedies against this insect, the author recommends the collection of the web cocoons by hand-picking, and their destruction.

Notes are given on certain flour and grain beetles, including the following species: *Tribolium ferrugineum*, *T. confusum*, and *Tenebrioides mauritanicus*. The remedies to be adopted against the first 2 species include careful cleaning of barrels, bins, or wooden depositories in which infested grain has been kept, heating flour to a temperature of 120 to 150° F., and fumigation with bisulphid of carbon. *Tenebrioides mauritanicus* was introduced into England from Africa, and is known to attack cereals, almonds, nuts, bread, etc. This species was observed to attack *Tribolium ferrugineum*. When the species attacks grain, it is recommended that the bags be disinfected and that the walls receive a thick coating of whitewash.

The grouse fly (*Ornithomyia avicularia*) is described, and notes are given concerning its appearance on other animals besides the grouse. A brief account is given of some of the anatomical structures of this insect.

A discussion is given of the following insects injurious to hops: *Agriotes obscurus*, *A. sputator*, *Athous rhombeus*, and *Psylliodes attenuata*. Notes are presented on the habits and life history of the 3 mentioned species of wireworms, including their occasional carnivorous habits. It had been suggested that rape cake might prove bene-

ficial in the destruction of wireworms, and experiments were tried with this substance with entirely negative results. Experiments were carried on by B. Dyer, during which 100 wireworms were placed in each of 3 jars of earth and fed, respectively, with castor-oil seed cake, rape cake, and nothing. At the end of 3 months it was found that of the 100 worms which had no food, 98 were alive; of those fed with castor-oil seed cake 93 were alive, and of those fed upon rape cake only 6 were alive. In the jar of earth which contained rape cake, uncongenial conditions were brought about by the decomposition of the cake, which was probably largely responsible for the death of the worms. The author gives a brief account of the life history and habits of *Psylliodes attenuata*. As remedies against this insect, the destruction of rubbish and old vines and applications of various substances to the soil about the roots of hops are recommended. The substances mentioned for this purpose include kainit, a mixture of kerosene and sawdust, gas lime, lime wash and Paris green, and Bordeaux mixture.

The author gives a detailed account of the life history, habits, and remedies to be used against *Ephestia kuehniella*. Whitewashing infested mills with fresh slaked lime and oil and fumigation were found to be effective remedies. According to the author's observations, the insect does not attack grain in Great Britain. Besides the remedies already suggested, all suspected material should be quarantined in a warm place for a sufficient length of time to allow the infestation, if present, to show itself. An experiment was tried in one mill of stopping work for a week, cleaning all machines, and treating the walls and floor of the mill with live steam and also with fresh slaked lime and kerosene. The results of this experiment were encouraging, although the pest was not entirely exterminated.

Insects injurious to the pear are discussed. The pear gnat midge (*Diplosis pyrivora*) is described and notes are given on the various points of its life history which are of economic importance. Experiments in preventive and remedial measures against this insect indicate that good results may be expected from gathering and destroying infested fruits and by removing and burying a thin layer of the soil from near the base of infested trees. Good results were also obtained by the application of kainit to soil around trees and from a similar use of muriate of potash. *Selandria atra* is reported as injurious to the pear and cherry. Notes are given on its egg laying and other habits. Experiments in combating this insect indicate that it is present in all stages in August, and that the application of kerosene emulsion is ineffective, as was also an application of hot lime. Paris green applied as a spray gave fairly good results. The author recommends the removal of the surface layer of infested ground to the depth at which the cocoons lie.

A land planarian (*Bipalium kewense*) is reported as having frequently been found in greenhouses and other situations, where it was suspected of being injurious. This group of flatworms, however, is not known to be injurious to plant life. This species is known to have lived in the Kew greenhouses for a period of about 8 years.

Dicranura vinula has attracted attention as being injurious to poplars and willows. Where the attacks of this insect become serious, the author recommends handpicking of the larvæ.

Notes are given on the habits and life history of *Lampronia rubiella*. Perhaps the most effective method of checking the attack of this insect consists in breaking off and destroying the infested buds of raspberries.

A species of slug (*Testacella haliotidea*) is described and notes are given on its habits. This species was observed eating earthworms, and is, therefore, considered to be a beneficial species in greenhouses.

The mottled willow weevil (*Cryptorhynchus lapathi*) has long been known to be injurious to willows and alders in England. Where signs of infestation by this species are present, the infested branches should be destroyed. When the beetles occur in large numbers on the foliage of these trees, they may be captured by the jarring method.

Brief notes are given on *Tmetocera ocellana*, *Cryptococcus fagi*, the winter application of caustic alkali solution for bark beetles of fruit trees *Cephenomyia rufibarbis*, and *Harpalus ruficornis*.

The Angoumois grain moth, J. B. SMITH (*New Jersey Stas. Bul. 147, pp. 8, figs. 2*).—This insect is reported as having been unusually injurious in 1900, causing a loss of about 25 per cent of the entire crop of wheat in the State. The author describes the insect and gives brief notes on its habits and life history. For preventing its ravages, it is suggested that grain be thrashed as soon after harvesting as possible and placed in tight bins or sacks. The grain should be tested occasionally in order to note any heating. If the grain heats decidedly, a serious infestation of the insect may be suspected, and carbon bisulphid should be used at once at the rate of 1 lb. per 250 cu. ft. of space, or 1 dram per cu. ft. It is also recommended that all barns and storehouses should be cleaned, so as to leave no exposed or scattered grain. Such grain may be fed to hogs and chickens.

Report on examination of wheat stubble from different sections of the State; the jointworm in wheat, A. D. HOPKINS (*West Virginia Sta. Bul. 69, pp. 333–350, pl. 1*).—The author examined wheat stubble from 24 counties of the State for the presence of the Hessian fly. He found that nearly all of the flaxseed stage were dead, and more than one-half of them had been killed by parasites. He interpreted these conditions as indicating that the wheat prospects were very encouraging. Tables are given with the names of correspondents, post-office address, dates of sowing, etc., together with the results of the examination of wheat stubble, for the purpose of show-

ing the comparative condition of wheat stubble in different parts of the State.

A brief account is presented of the appearance, life history, and habits of the jointworm. In combating the attacks of this insect, it is recommended that all wheat, barley and rye stubble should be composted or burned before the first of May. The author also recommends cutting grain as high as practicable, and subsequent mowing and collection of the stubble.

The periodical cicada or 17-year locust in West Virginia, A. D. HOPKINS (*West Virginia Sta. Bul. 68, pp. 257–330, pls. 3, figs. 4*).—This bulletin contains a brief account of the anatomy, habits, life history, and broods of the periodical cicada. Notes are given from correspondence relating to the distribution and extent of such broods occurring within the limits of the State. The author states that the cicada probably does not occur in West Virginia above an elevation of 3,300 ft. The time of appearance is influenced to some extent by the average summer temperature, a difference of 3½ days in time of appearance having been noted for each degree of difference in summer temperature. Attention is called to the subsequent attacks of woolly aphis in the wounds caused by the cicadas in depositing their eggs. Tree crickets and certain fungus diseases also find a more easy entrance to trees at such points. The wounds which result from the sting of the cicada may persist for a number of years and cause distortion in the branches of the trees. For preventing serious injury in this way, it is recommended that trees should be severely pruned during the fall after a visitation of cicadas. Especially severe wounds were noted in sugar maple.

Maps are given, showing the distribution of the broods which will emerge in 1901, 1902, and 1905, and warnings are issued for these and other broods. It is recommended that no young fruit trees should be planted in the fall or spring previous to the appearance of the brood of the cicada.

Observations on field slugs and on experiments for the purpose of destroying them, G. DEL GUERCIO (*Nuove Relaz. R. Staz. Ent. Agr., 1. ser., 1900, No. 2, pp. 237–267, figs. 2*).—The author discusses the literature relating to *Limax agrestis* in connection with a brief bibliographical list. The plants in Italy which are most commonly attacked by this animal are hemp, beans, kidney beans, peas, clover, lucern, wheat, rye, barley, and oats. The injuries caused by the field slug are more or less serious every year, but during certain years the slugs have been so numerous as to cause alarming depredations. The natural conditions which are most favorable for the development of Limax are moisture and green vegetation in abundance. Dry areas present a formidable barrier to the distribution of Limax.

The natural enemies of the field slug observed in the greatest abundance by the author are Talpa, Gryllotalpa, *Procrustes coriaceus*, *Silpha lævigata*, and *Lampyris noctiluca*. A great variety of remedies were tried by the author for the purpose of destroying the field slug. Among the pulverized insecticides, mention should be made of carbonate, oxid, hydroxid, sulphate, and sulphid of calcium, ashes, dust, sulphur, pyrethrum, chrysanthemum, and tobacco. White hydroxid of calcium dusted upon the field slug caused a severe irritation of the skin which resulted in the death of the majority of them. The brown hydroxid of calcium and the oxid of calcium were less efficacious. Ashes proved to be of little value, as nearly all the Limax dusted with this substance ultimately escaped. Pyrethrum powder and dusted tobacco were of little avail in combating the field slug. Nearly the same list of substances was tried by way of direct applications on plants for the purpose of preventing the attack of the field slug.

From the numerous insecticide experiments conducted by the author, it is concluded that pulverized white hydroxid of calcium or the same substance in a 1 to 2 per cent solution in water is the most active remedy for the destruction of the field slug. As the second most effective remedy, the author mentions white oxid of calcium. According to his experiments, the most appropriate time for applying artificial remedies in the destruction of Limax is from 8 to 9 o'clock in the evening.

Means of protecting barks and woods against insects, E. Mer (*Bul. Soc. Nat. Agr. France, 60 (1900), No. 11, pp. 673, 674*).—It was observed by the author that two years after ringing a number of cork oaks, the region immediately above the ring was badly infested with bark beetles and had been much visited by woodpeckers for the purpose of feeding upon these insects. The region immediately below the ring, however, was entirely free from bark beetles. Since it is known that ringing, if performed so deeply as to injure the cambium, has the effect of causing an accumulation of starchy materials immediately above the cut and the almost complete absence of such materials below the cut, it is suggested by the author to use any means which will hasten the resorption of starch from the bark or which will serve to protect this substance from future insect attacks. Specimens which are intended for museum purposes may be cut in winter or early spring from branches out of which the reserve materials have been removed for winter storage to a lower position.

Spraying, L. C. Corbett (*West Virginia Sta. Bul. 70, pp. 353–382, figs. 17*).—A test of the value of spraying was made on an apple orchard 30 years old, with trees standing 33 ft. apart. The trees were regularly sprayed through the season of 1899. In 1900 the orchard was sprayed with Bordeaux mixture and Laurel green, the applications being made on April 19, May 23, June 8, and June 23. The results

indicate that this treatment increases the fruit crop to an extent which warrants the fruit grower in spending the necessary time and money for making the applications. On the Rambo apple trees the yield of fruit was increased 18.3 per cent, and on the Beauty of Kent 62 per cent.

Experiments for checking the attacks of the codling moth show that 12 oz. of Laurel green to the 100 gal. of Bordeaux mixture had little, if any, effect upon the number of the codling moth. A single application of 5 oz. of Paris green to 50 gal. of the Bordeaux mixture reduced the injury from the codling moth to a considerable extent. In this connection, brief notes are also given on the use of arsenate of lead.

Experiments were tried in using a combination of Bordeaux mixture and kerosene, containing 10 to 15 per cent of the latter. The application was made to pears, apples, and plums on April 26 and May 12. No injury to the foliage resulted, and the apple aphis seemed to be entirely destroyed by both the 10 and 15 per cent kerosene combinations.

The author tested the possibility of making Bordeaux mixture by mechanical methods. Two lbs. of copper sulphate were dissolved in 4 gal. of water, and 2 lbs. of lime in 12 gal. of water. The copper sulphate solution was placed in an oil tank and the limewater in the barrel of a Kerowater pump. The pump was set to make a 25 per cent mixture, and thus the lime and copper sulphate were delivered in equal quantities in the nozzle. The only advantage of this method is the lessened liability to clog the pump and nozzle.

A test was made of a combination of tobacco and kerosene emulsion as a remedy for rose bugs. The mixture was made by combining the Riley kerosene emulsion with 2 gal. of tobacco tea. This spray was applied to peach trees without damage to the foliage. Little effect was shown on the rose bugs, since they are of a migratory nature and difficult to combat.

The author gives a brief description of the appearance of the San José scale. Notes are also presented on the spread of this insect in West Virginia. Experiments were tried in combating the San José scale with whale-oil soap, made by dissolving 2 lbs. of soap in a gallon of water, dilute kerosene (150° test), in a 25 per cent mechanical mixture with water, and pure kerosene and crude petroleum in a 20 per cent mixture with water. In preparing these insecticides, it was found that whale-oil soap offered the greatest difficulties. None of the other mixtures require especial preparation. The spraying work was begun on March 28. An inspection of the work on May 16 and on October 12 showed that whale-oil soap had killed a large percentage of the scales and had caused no injury to the trees. Pure kerosene caused no damage to the foliage and killed the scales on the parts of

the trees which had been thoroughly sprayed. A 25 per cent mechanical mixture of kerosene did no damage to the trees, but some live scales were found upon fruit and branches of the trees. The 20 per cent mixture of crude petroleum caused no injury to peach, plum, or apples and killed all scales with which it came in contact. Undiluted crude petroleum was also employed on a small scale on Japanese plum trees with good results and without injury to the tree. Undiluted petroleum was tried in another locality with similar results, the trees having been subsequently found entirely free from living scales. The author states that the undiluted crude petroleum treatment gave the best results of any method which was tried.

The composition of arsenical insecticides, S. Avery (*Idaho Sta. Bul. 25, pp. 11*).—Analyses were made of 19 samples of Paris green obtained from dealers in different parts of the State. An average of these samples showed copper oxid 30.49 per cent and arsenious acid 56.86 per cent, 3.35 per cent of the latter being soluble. The author estimates that 3 per cent of commercial Paris green may be considered as foreign substances and moisture, which are perhaps unavoidable. The assumption that Paris green is insoluble in water is incorrect, since 55 per cent of the arsenic contents in a pure sample of Paris green was extracted by means of distilled water alone. The author considers the methods of solution in ammonia and passing Paris green over a glass slide to be of some value in determining its quality, but recommends as the only entirely satisfactory test a chemical analysis.

Tests made on the samples of London purple indicated that considerable lime was present in the form of the carbonate. Several samples of Arsenoids were examined by the author, with especial reference to the relative capacity of the bases which they contained to form insoluble compounds with arsenious acid. It was found that the tendency of arsenite of lime to give off soluble arsenic is somewhat reduced by increasing the excess of lime. Brief notes are also added on copper arsenite, barium compounds, lead compounds, and home-made arsenite of lime.

The honeybee, R. Helms (*Jour. Dept. Agr. West. Australia, 2 (1900), No. 6, pp. 409-413*).—The author calls attention to the great variety of plants in Australia which yield nectar. A considerable number of these plants produce flowers over an extended period. Another advantage for bee keepers in Australia is the mild climate.

The differentiation of cell elements in the ovary of the queen bee, W. Paulcke (*Zool. Jahrb., Abt. Anat., 14 (1900), No. 2, pp. 177-202, pls. 4, fig. 1*).—The author gives an account of the generations of cell divisions in the ovaries of queen bees with reference to the proportion and purpose of the nutritive cells and cells which ultimately become eggs. The details of cell differentiation are described for both varieties of cells. A bibliography of the subject is appended.

Drone production, A. Gale (*Agr. Gaz. New South Wales, 11 (1900), No. 12, pp. 1095-1098*).—The author gives a popular discussion of the relationship of drones to the rest of the colony and to the problem of parthenogenesis in bees.

Do bees damage fruit? J. B. SMITH (*Rural New Yorker, 59 (1900), No. 2655, p. 830*).—The author discusses this subject with especial reference to the evidence presented by Professor Jablownsky of the injury to grapes by bees in Hungary.

The bee moth (*Jour. Jamaica Agr. Soc., 5 (1901), No. 1, pp. 16, 17*).—Brief notes on the habits and life history of this insect. In combating the bee moth it is suggested that the colonies should be kept in a vigorous condition and that infested colonies should be removed to another hive and the old frames fumigated with sulphur.

Spider or lice flies that infest horses, sheep, and other animals, W. W. FROGGATT (*Agr. Gaz. New South Wales, 11 (1900), No. 12, pp. 1088–1094, pl. 1*).—The author gives a brief account of the appearance, habits, and life history of *Hippobosca equina*, *H. rufipes*, *H. bactriana*, *H. canina*, *Olfersia macleayi*, and *Melophagus ovinus*. Mr. E. Stanley reports the case of a pony which became uncontrollable under the irritating attacks of *H. equina*.

The more common insect pests of the farm and market garden, A. M. LEA (*Jour. Dept. Agr. West. Australia, 2 (1900), No. 6, pp. 399–408, figs. 8*).—This article contains brief notes on the chinch bug, Hessian fly, Australian chinch bug (*Nysius vinitor*), Australian plague locust (*Pachytilus australis*), the bollworm, *Anoplostethus opalinus*, and species of thrips and mites, including red spider and other species.

The enemies of cereals, V. MAYET (*Prog. Agr. et Vit. (Éd. L'Est), 21 (1900), No. 52, pp. 790–794*).—The author gives an account of the habits and life history of *Cephus pygmaeus*. This species is attacked by a hymenopterous parasite, *Pachymerus calcitrator*. The wheat nematode *Tylenchus tritici* is reported as exceedingly injurious in certain localities. A detailed description is given of the worm. In order to destroy the nematodes in seed wheat the author recommends soaking the wheat for 24 hours in a solution of 1 part sulphuric acid in 150 parts of water.

Entomologist's report, A. KOEBELE (*Hawaiian [Sugar Planters'] Sta. Rpt. 1900, pp. 40–42*).—Brief notes are given on insects which were found on dead and dying sugar cane. Ants were found in considerable numbers, but were probably attending the mealy bug, *Dactylopius calceolariæ*. Nematode worms were found in dying roots, but were probably not injurious to living sugar cane.

Notes on insect pests from the entomological section (*Indian Mus. Notes, 5 (1900), No. 2, pp. 39–54*).—The chief insect enemies of sugar cane during the year were *Chilo simplex*, *Ripersia sacchari*, *Dictyophora pallida*, and *Termes taprobanes*. *Hispa aenescens* is reported as very destructive to cereal crops, especially in paddy fields. Experiments were tried in dusting the plants with sulphur, smoking with sulphur, and spraying with copper sulphate solution 1 part to 100 and 1 part to 200 of water, and with carbolic acid solution 1 part to 20 parts of water. The insects dropped off the leaves as soon as the last-mentioned insecticide touched them, but seemed later to recover. The bollworm was reported as damaging paddy seedlings and cotton in several localities. Brief notes are given on insect pests of maize, wheat, tea, cocoanut palm, and forest trees.

The Hessian fly, A. E. JENKS (*Amer. Thresherman, 3 (1901), No. 9, pp. 42, 43, figs. 2*).—The author discusses briefly the history of the Hessian fly, its present distribution in the United States, the means for its dispersal, the appearance of the insect in its different stages, its food plants, natural enemies, and the most effective remedies which have been recommended against it.

Description of a new species of Ripersia destructive to sugar cane, E. E. GREEN (*Indian Mus. Notes, 5 (1900), No. 2, pp. 37, 38, figs. 2*).—*R. sacchari* is described as a new species, and reported as occurring on the leaves of sugar cane. The insect has a more or less globular form, and in appearance seems to be most closely related to *R. pulvinaria*, which appears on grasses.

The cane shot borer (Xyleborus perforans), L. ZEHNTNER (*Meded. Proefstat. Suikerriet. West Java, 1900, No. 44, pp. 21, pl. 1, dgm. 1*).—The author gives a detailed account of the habits of this insect, which usually attacks sugar cane at the nodes.

A discussion is also given of the injury caused by the beetle. The insect is described in detail in its various stages.

The author believes that there is no urgent demand for insecticide methods against this insect, since apparently its attacks are for the most part confined to sugar cane which is already infested with some fungus disease. The prompt removal and destruction of canes which are infested with any fungus disease is suggested as a good means for preventing further injury by the shot borer.

The fruit fly, A. H. BENSON (*Queensland Agr. Jour., 7 (1900), No. 6, p. 524*).—For the destruction of this insect the author recommends that all infested fruit should be boiled. It is considered especially important to destroy the early brood of larvæ.

The Dermaptera and Orthoptera of Austro-Hungary and Germany, J. REDTENBACHER (*Die Dermatopteren und Orthopteren von Österreich-Ungarn und Deutschland. Vienna: Carl Gerold's Son, 1900, pp. 148, pl. 1*).—The author discusses briefly the general anatomy, different methods of capture and study of these groups of insects. A systematic account is presented of the different species which occur within the limits indicated. A bibliography of the subject is appended.

Illustrated analytical fauna of the Orthoptera of France, C. HOULBERT (*Faune analytique illustrée des Orthoptères de France. Paris: Emile Deyrolle's Sons, 1900, pp. 55, figs. 218*).—The author gives analytical tables by which the species of Orthoptera which occur in France may be determined. The majority of the species are illustrated. The anatomy of this group of insects is briefly discussed, and a bibliography of related literature is given.

The natural history of the British Lepidoptera, J. W. TUTT (*London: Swan Sonnenschein & Co., 1899, Vol. I, pp. 560*).—The present volume is divided into 2 parts, of which the first contains a general discussion of the origin of Lepidoptera, the egg, embryology, parthenogenesis, external and internal structure of caterpillars, variation of moths, protective coloration, and a system of classification of Lepidoptera. The second part of the volume begins a detailed discussion of the families of this order. The practical value of this volume is considerably increased by full bibliographical references.

The critical point in insects and the origin of butterfly aberrations, P. BACHMETJEW (*Illus. Ztschr. Ent., 5 (1900), No. 6, pp. 86-89*).—If adult or larval insects are kept at a temperature of —25° C. their body temperature is gradually diminished, and during this time certain peculiar developments are observed. At about —10° C. the body temperature of the insects is suddenly elevated up to —1.5° C. or to 0° C. The elevation of temperature is explained by supposing that latent heat is set free by the process of passing into the so-called cold rigor. The observations of the author were carried out upon a considerable variety of insects.

On certain seasonal phases of butterflies of the genus Precis, A. G. BUTLER (*Entomologist, 34 (1901), No. 452, p. 7*).—A brief discussion of the various forms of the species belonging to this genus.

Description of a new species of Aleurodes destructive to betel, G. B. BUCKTON (*Indian Mus. Notes, 5 (1900), No. 2, p. 36, figs. 3*).—A species described under the name *A. nubilans* is reported as occurring in large numbers on the under side of betel leaves in the form of small scales, difficult to detach. The larvæ were tufted with yellow material, each thread forming a continuous spiracle.

On the occurrence of Colias edusa and C. hyala, and the results of rearing the variety helice from helice ova, F. W. FROHAWK (*Entomologist, 34 (1901), No. 452, pp. 2-5*).—The results obtained from experiments with the variety helice indicated that this form was almost as numerous as the normal females, the same number of each having emerged for several days.

The claws and pulvilli of Diptera, J. J. KIEFFER (*Illus. Ztschr. Ent., 5 (1900), No. 22, pp. 339, 340, pl. 1*).—A brief anatomical study of the structures.

Notes on the life history of Anopheles maculipennis, L. W. SAMBON (*British Med. Jour., 1901, No. 2091, Epit., pp. 195-199, pl. 1, figs. 8*).—The author describes

from the literature of the subject and from personal observations, the various details of structure, life history, and habits of this species in all its stages. Especial attention is given to a discussion of the breeding grounds of these mosquitoes.

New guests of the Dorylinæ of the Neotropic and Ethiopian regions, E. WASMANN (*Zool. Jahrb., Abt. Syst., 14 (1900), No. 3, pp. 215-289, pls. 2*).—This paper contains a discussion of the robbing habits of these ants, together with brief notes on their so-called "guests," and descriptions of new species.

The larva of Lonchoptera, J. C. H. DE MEIJERE (*Zool. Jahrb., Abt. Syst., 14 (1900), No. 2, pp. 87-132, pls. 3*).—An elaborate account of the anatomical structure and physiological relations of this genus.

A report on the injurious outbreaks of Lymantria monacha in Södermanland and Östergötland in the year 1899, together with measures for combating this insect, J. H. WERMELIN ET AL. (*Ent. Tidskr., 21 (1900) No. 2, pp. 97-111*).—An apparently infectious disease of the larvæ of this species was noted and tables were given showing the number of diseased and parasitized larvæ among a large number of specimens which were collected. Brief notes are given on the insect enemies of the insect in its various stages. In combating the attacks of this insect Raupenleim and banding methods were used.

Description of a new species of Psylla, destructive to forest trees, G. B. BUCKTON (*Indian Mus. Notes, 5 (1900), No. 2, pp. 35, 36, figs. 6*).—A technical description is given of a new species under the name of *P. obsoleta.* The insect was reported as injurious to young specimens of *Diospyros melanoxylon.* The leaves of the young plant were attacked and galls were formed. The insect left its gall in January or February. After the departure of the insect the galls disappeared, leaving small holes in the leaves.

A hemipterous insect parasite upon Hyponomeuta malinellus and H. padelus, A. GIARD (*Bul. Soc. Ent. France, 1900, No. 18, pp. 359, 360*).—The larvæ of these insects are reported as being parasitic to a considerable extent upon *Atractotomus mali.*

FOODS—ANIMAL PRODUCTION.

The availability and fuel value of food materials, W. O. ATWATER and A. P. BRYANT (*Connecticut Storrs Sta. Rpt. 1899, pp. 73-110*).—The authors discuss the so-called availability of foods (see p. 1075), the proportion of nutrients supplied by different groups of food materials in the average diet, the availability of different classes of nutrients in food of mixed diet, heats of combustion of nutrients, fuel value, and related topics. The discussion is based upon the results of nutrition investigations carried on under the auspices of the Department of Agriculture as well as those carried on at the station. A large number of analyses have shown that the ordinary factor for computing protein, *i. e.*, 6.25, is not applicable to all classes of food. The following factors are proposed:

Proposed nitrogen factors for the protein of different groups of food materials.

Kind of food material.	Factors proposed.	Factors for recalculating protein.
Animal foods	6.25	....
Wheat, rye, barley, and their manufactured products	5.70	0.912
Maize, oats, buckwheat, and rice, and their manufactured products	6.00	.960
Dried seeds of legumes	6.25	....
Vegetables	5.65	.904
Fruits	5.80	.928

As regards heat of combustion and fuel value, the following statements are made:

"Taking into account (1) the heats of combustion of the protein compounds, fats, and carbohydrates which occur in different groups of food materials, and (2) the average proportion in which the different nutrients are furnished by different food materials in the ordinary mixed diet, the average heat of combustion of 1 gm. of protein, fat, and carbohydrates in such diet is approximately 5.65, 9.40, and 4.10 calories, respectively.

"One gram of total protein of mixed diet burned in the body yields on the average not far from 4 calories, 1 gm. of fat 8.9 calories, and 1 gm. of carbohydrates 4 calories of energy. The corresponding values per pound are 1,820, 4,240, and 1,820 calories. One gram of available protein, on the other hand, has a fuel value of 4.4 calories, 1 gm. of available fats 9.4 calories, and 1 gm. of available carbohydrates 4.1 calories. These values correspond to 2,000, 4,260, and 1,860 calories per pound.

"Of course these figures are not to be regarded as final, and alterations may be called for as data accumulate. Meanwhile we think that they are sufficiently accurate for ordinary use."

The relative proportion of total food and total nutrients supplied by a number of food materials and groups of foods, as shown by the results of 185 dietary studies, follow:

Relative proportions of total food and of total nutrients supplied by different groups of food materials in average of 185 dietary studies.

Kind of food material.	Total food.	Protein.	Fat.	Carbohydrates.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Beef and veal	10.3	24.6	19.5	....
Mutton and lamb	1.4	3.3	3.8	....
Pork	5.4	8.8	30.0	....
Poultry	1.1	2.6	1.2	....
Fish, shellfish, etc	1.9	3.7	.8	0.1
Total meat, etc	20.1	43.0	55.3	.1
Eggs	3.0	5.9	4.3	....
Butter	1.9	.2	19.7	....
Cheese	.4	1.6	1.6	....
Milk and cream	19.9	10.5	10.7	5.3
Total dairy products	22.2	12.3	32.0	5.3
Total animal food	45.3	61.2	91.6	5.4
Corn meal, rye, and buckwheat flour	1.8	1.9	.4	5.2
Oatmeal, rice, and wheat preparations	1.3	2.1	.6	3.6
Wheat flour, bread, crackers, pastry, etc	18.7	26.5	6.0	45.9
Total cereal products	21.8	30.5	7.0	54.7
Starch	.1	....	....	.2
Sugar	5.5	....	....	21.0
Dried legumes	.6	2.0	.1	1.3
Potatoes and sweet potatoes	13.7	3.9	.3	10.0
Other vegetables	7.4	1.8	.4	2.5
Total vegetables	21.1	5.7	.7	12.5
Fruits	5.6	.6	.6	4.9
Total vegetable food	54.7	38.8	8.4	94.6
Total food	100.0	100.0	100.0	100.0

The average coefficients of availability of the nutrients of different groups of food materials and of the total nutrients of a mixed diet are given.

"The results of a considerable number of digestion experiments with mixed diet give averages for coefficients of availability as follows: For protein, 92 per cent; fats, 95 per cent, and carbohydrates 97 per cent."

Studies of dietaries of college students and of members of families of professional men, W. O. ATWATER and R. D. MILNER (*Connecticut Storrs Sta. Rpt. 1899, pp. 124–149*).—Details are reported of a dietary study with college students, a chemist's family, and a chemist. The students and the chemist were young men in good health. The subject of one of the studies, No. 316, boarded himself during a summer vacation. Most of the foods eaten were such as could be purchased already prepared or canned. A very considerable number were of vegetable origin. In the dietary study of the chemist's family, No. 317, the special object was to determine whether salt codfish and dried beans prepared in different ways could be used with satisfaction as sources of protein in place of a considerable portion of the meat ordinarily used. The results of the dietary studies follow:

Average results of dietary studies; quantities consumed per man per day.

	Cost.	Protein.	Fat.	Carbohydrates.	Fuel value.
	Cents.	*Grams.*	*Grams.*	*Grams.*	*Calories.*
College student (No. 316)	31.7	145	115	522	3,810
Chemist's family (No. 317)	20.8	100	130	380	3,180
College student (No. 318)		139	138	601	4,315
College student (No. 319)		91	98	422	3,105
College student (No. 320)		104	98	426	3,085
Chemist (No. 321)		126	138	395	3,420
College student (No. 322)		160	135	351	3,350

Investigations on the metabolism of matter and energy of full-grown steers on a maintenance and on a productive ration, O. KELLNER, A. KÖHLER, ET AL. (*Landw. Vers. Stat., 53 (1900), pp. X+474*).—Continuing the experiments with steers on the metabolism of matter and energy at the Möckern Experiment Station (E. S. R., 10, p. 669), the authors report in detail a considerable number of investigations. These include four series, aggregating 39 individual experiments of an average duration of 14 days. A total of 159 respiration experiments were made, each of 24 hours' duration, with the Pettenkofer respiration apparatus. In the first series the ration consisted of gluten and starch; in the second, of gluten, starch, and oil; in the third, of meadow hay, oat straw, starch, oil, and molasses; and in the fourth, of meadow hay, oat straw, starch, extracted rye straw, and molasses. The composition and digestibility of the ration was studied; record was made of the water consumed and its content of carbon dioxid; the urine was analyzed; the carbon in the gaseous excretory products, the nitrogen, and carbon balance were determined, as well as the fuel

value of the income and outgo. From the observed data the gains in fat and muscular tissues were calculated, as was also the energy balance. Detailed records were kept of the temperature of the stalls, and all the experimental data of the metabolism, digestion, and respiration experiments are recorded in detail, the experimental data being followed by a general discussion of results and statements of some of the principal conclusions and deductions. A number of these conclusions and deductions follow:

On an average it was found that the steers consumed 1 kg. of water per 3.3 kg. of dry matter in the food. Of the water consumed as such and in the food, 46.3 per cent was excreted in the feces and 29.2 per cent in the urine.

The investigations of the fuel value of the food and excretory products indicate that within wide limits it is possible to calculate the true energy value of the digested food with a reasonable degree of accuracy. In the experiments reported the fuel value per gram of digestible material was calculated for a number of feeding stuffs when added to a maintenance ration. The values obtained were the following: Starch, 4,185 calories; gluten protein, 6,148; peanut oil, 8,821; molasses, 4,075; "straw-like material," i. e., crude fiber and nitrogen-free extract, 4,247; meadow hay, 4,437; oat straw, 4,513, and wheat straw, 4,470 calories.

In the different experiments determinations were made of the amount of methan excreted, and the proportion of methan carbon to total digestible carbon and to carbon of nitrogen-free extract and crude fiber was calculated. On an average it was found that there was produced per 100 parts of digestible carbohydrates 3.14 parts of methan carbon = 4.2 parts of methan. According to the authors, the digestible protein present in the ration had no direct effect on the formation of methan. Fat and oil in the finely divided form in which they were consumed in the ration did not produce methan fermentation. Oil consumed as such in large quantities hindered this fermentation.

The fuel value of the urine was determined under the different food conditions of the several experiments. In effect, the authors state that the determinations made in the 44 experimental periods indicate that within certain bounds, as regards protein consumed, the carbon content of the urine furnishes a very nearly accurate measure of the fuel value of the total dry matter of the urine.

The "physiological-nutritive value" of the different feeding stuffs is discussed. By this term the authors mean the amount of energy which remains for the use of the body after the energy necessary for the labor of chewing and digestion, or formation of urea, is deducted. The physiological nutritive value per gram of the different feeding stuffs tested, when forming a part of a ration for maintenance and when

constituting that portion of the ration which serves for production, is shown in the following table:

Physiological nutritive value of different feeding stuffs.

Feeding stuffs.	In ration for maintenance.	In amount available for production.	
	Calories.	*Per cent.*	*Calories.*
Gluten protein	4,958	45.2	2,241
Peanut oil	8,821	56.3	4,966
Starch	3,760	58.9	2,215
"Straw-like material"	3,651	63.1	2,304
Molasses No. 1	3,829	58.9	2,255
Molasses No. 2	3,462	68.3	2,365
Meadow hay No. 5	3,553	40.2	1,428
Meadow hay No. 6	3,728	42.8	1,596
Oat straw	3,747	37.6	1,409
Wheat straw	3,327	17.8	592

The authors calculate that fat is formed from starch according to the following equation: 100 gm. starch + 38.69 gm. oxygen = 3.17 gm. methan + 23.4 gm. water + 88.77 gm. carbon dioxid + 23.34 gm. fat. The results of the tests are believed to show further that protein is to be regarded as a source of fat. The digestible crude fiber in the straw freed from encrusting material is stated to possess a nutritive value not at all inferior to that of digestible starch. The furfurol-yielding substances of a ration are regarded as not inferior to starch or cellulose for the formation of fat. The easily digestible cellulose of extracted rye straw, in the authors' opinion, protected protein and rendered it available for the formation of muscular tissue.

The following are enumerated as the causes of the loss of energy when organic substances are digested, absorbed, and converted into body tissue: (1) The labor of chewing and digesting, including that required for the absorption of water to moisten the food for solution and the action of enzyms in the feeding stuffs; (2) the formation of methan by fermentation which, as shown by the authors' observations, is limited to the nitrogen-free material and crude fiber and does not concern the protein and fat; (3) destruction of food by the large number of micro-organisms in the intestinal tract, further aided by the length of time the material remains in the intestinal tract of ruminants; (4) the incompletely oxidized material which is excreted in the urine; and (5) the molecular rearrangement of absorbed material when it is converted into body substance, a change which probably requires a considerable energy expenditure.

Further, the productive value of feeding stuffs depends not alone, according to the authors, upon its content of digestible nutrients, but is materially affected by the physical properties of cell tissue and the presence of undigestible so-called encrusting substances. All such conditions which increase the labor of chewing and digesting or the solution and absorption of the nutrients enclosed in cells, diminish the

productive value of a feeding stuff. Whether the food is rapidly assimilated by the aid of the saliva and juices of the stomach, or whether absorption is brought about in the lower portion of the intestinal tract by decomposition is a matter of great importance.

Feeding steers, G. H. TRUE (*Arizona Sta. Rpt. 1900, pp. 171–174, pl. 1*). According to the author it is a generally accepted fact that while cattle fatten rapidly on alfalfa, they can not be finished for market on this feed alone so as to compare profitably with animals finished on grain. Local feeders have reported favorable results on the use of sorghum fodder as a supplement to alfalfa. The author tested the comparative value of cured corn fodder, Kafir corn fodder, and sorghum fodder as a supplement to alfalfa hay with 2 lots of 4 steers each. During the first 5 weeks of the test lot 1 consumed 1,512 lbs. alfalfa and 1,247 lbs. corn fodder, and made an average daily gain of 1.39 lbs., while lot 2 (fed throughout the test alfalfa hay only) consumed a total of 2,929 lbs. of alfalfa and made an average daily gain of 1.03 lbs. per head daily. When Kafir corn fodder was substituted for corn fodder, in the next 5 weeks of the test, lot 1 ate 1,575 lbs. alfalfa hay and 1,333 lbs. Kafir corn fodder, and gained on an average 1.68 lbs. per head daily. In the same time lot 2 consumed 2,853 lbs. alfalfa hay and gained 1.65 lbs. per head daily. During the following 6 weeks, sorghum fodder was substituted for Kafir corn, and lot 1 consumed 1,890 lbs. alfalfa hay and 1,814 lbs. of sorghum, and gained 1.65 lbs. per head daily. Lot 2 consumed a total of 2,828 lbs. alfalfa and gained 1.67 lbs. per head daily. Considering the test as a whole the gains made by the lot fed alfalfa hay and other forage was 711 lbs. as compared with 652 lbs. on alfalfa hay alone, a difference which the author regards as insufficient for definite conclusions. At the close of the test the lots were rearranged so as to counterbalance the effect of previous rations and each lot was pastured for 8 weeks on 2 acres of alfalfa. Lot 1 was fed sorghum fodder, and lot 2 alfalfa hay in addition. The average daily gain per steer in lot 1 was 1.63 lbs., and in lot 2, 1.55 lbs.

Sheep feeding, G. H. TRUE (*Arizona Sta. Rpt. 1900, pp. 175, 176*). The comparative value of alfalfa hay and of sorghum fodder alone, mixed, and supplemented by sugar beets was tested with 5 lots of 8 sheep each. In 4 weeks lot 1, on a daily ration of 40 lbs. of chopped sugar beets and 20 lbs. of alfalfa, gained on an average 0.259 lb. per head daily. Lot 2, fed 40 lbs. sugar beets and 20 lbs. sorghum fodder daily, made an average daily gain of 0.286 lb. per head. The average daily ration of lot 3 was 40 lbs. alfalfa hay, and lot 4, 40 lbs. of sorghum fodder, and of lot 5, 10 lbs. alfalfa hay and 30 lbs. of sorghum fodder. The average daily gain per head in these 3 lots was 0.187, 0.125, and 0.232 lb., respectively. Although the author believes the test insufficient for general deductions, the fact is pointed out that

there was an undoubted advantage in the use of sugar beets, *i. e.*, succulent food, as part of a ration. At the end of the trial the sheep were not in condition for market and were pastured for 4 months on burr clover or alfalfa, and were fed wheat hay or barley in addition. They were then sold. From the beginning of the test to the end of the pasturage period the average daily gain was 0.32 lb. per day.

On the amount of water in slop fed fattening pigs, C. S. PLUMB and H. E. VAN NORMAN (*Indiana Sta. Bul. 86, pp. 151–158*).—The comparative value of grain fed dry and mixed with different amounts of water was tested with 4 lots of 3 pigs each. For the first 15 weeks of the trial the grain used was corn meal and shorts, 1:1, and for the remaining 6 weeks of the test hominy chop replaced the corn meal. Lot 1 was fed the ration dry; lot 2 received it mixed with an equal amount of water. For lot 3 the grain was mixed with twice, and for lot 4 with three times, its weight of water. In addition to dry grain or slop, the pigs were given all the drinking water they desired, the amounts consumed being recorded. The average daily gain of the 4 lots was $4\frac{1}{3}$, $4\frac{2}{5}$, $4\frac{2}{5}$, and $4\frac{1}{5}$ lbs.; the grain consumed per pound of gain was 3.59, 3.80, 3.74, and 3.75 lbs., while the cost of food per pound of gain was 2.87, 3.04, 2.99, and 3 cts., respectively. Lot 1 drank a considerable amount of water; lot 2 a somewhat smaller amount, while lots 3 and 4 received all they wished in the slop fed. During the test the total amount of water drank by lot 1 was 3,379.5. Lot 2 received a total of 3,031 lbs., while lots 3 and 4 received 4,871.3 and 6,927.9 lbs., respectively.

"Pigs weighing 60 lbs., fed dry feed, consumed on an average 2.35 lbs. daily, and this amount increased nearly constantly until these same pigs, weighing 218 lbs., consumed 11.07 lbs. per day. It is also shown that pigs fed water in their food as a slop, when weighing about 60 lbs., consumed either 2.42, 4.25, or 5.79 lbs. of water per day, while these same pigs weighing 213 to 222 lbs. consumed either 8.17, 14, or 18 lbs. of water per day. Undoubtedly much of this water was consumed unnecessarily, and certainly lot 4 was given much more water with its grain than was required.

"There was no material difference in the appearance of the pigs in either lot, so far as quality is concerned, and so far as this one experiment goes the use of about two times the weight of water to grain indicates a satisfactory proportion. In view of the fact that the pigs fed dry grain made slightly [better gains than the others], it would appear that there is really no gain in feeding the pigs a slop instead of a dry grain, excepting as a feeder may regard it a matter of convenience."

Discussion of the terms digestibility, availability, and fuel value, W. O. ATWATER (*Connecticut Storrs Sta. Rpt. 1899, pp. 69–72*).—The terms availability, digestibility, and fuel value are discussed at some length and explained. It is proposed to use availability for what is ordinarily termed digestibility—*i. e.*, the total nutrients consumed less the amounts of each excreted in the feces. The author proposes the term digestibility for what is ordinarily called digestibility, with corrections introduced for the metabolic products in the feces. "[By fuel value] is understood the energy (heat of combustion) of the material of the food which is oxidized—*i. e.*,

capable of oxidation in the body. For the total food it is the total energy less that of the corresponding unoxidized materials of the feces and urine. For the protein it is likewise the total heat of combustion less that of the corresponding unoxidized residues of these excretions. For the fats and carbohydrates it is the total energy less the energy of the corresponding unoxidized material of the feces."

Composition of common food materials—available nutrients and fuel value, W. O. ATWATER and A. P. BRYANT (*Connecticut Storrs Sta. Rpt. 1899, pp. 111–123*).—Using the coefficients of availability quoted above (p. 1069) the authors calculated the available nutrients (*i. e.*, what is generally designated as digestibility) in a large number of animal and vegetable foods.

Meat extract and meat peptone, H. BREMER (*Chem. Ztg., 24 (1900), No. 79, pp. 838–841*).—A general discussion with much historical data.

On the extractive substance of muscular tissue, W. GULEWITSCH and S. AMIRADŽIBI (*Ztschr. Physiol. Chem., 30 (1900), No. 6, pp. 565–573*).—From meat extract the authors isolated and studied a substance which they consider a new base and to which the name "carnosin" is applied.

Has meat extract nutritive value? L. FÜRST (*Chem. Ztg., 24 (1900), No. 91, pp. 994, 995*).—A general discussion.

Banana [and breadfruit] flour, W. KIRKLAND (*Jour. Jamaica Agr. Soc., 4 (1900), No. 11, pp. 668, 669*).—A descriptive article.

Cassava culture in Java; its uses by the natives and for the manufacture of tapioca flour, H. C. DE BIE (*Teysmannia, 11 (1900), No. 6, pp. 273–298*).—Cassava culture in Java is reviewed and a description given of the preparation of tapioca flour. The crude product of native manufacture is further refined, yielding a pure, white flour and a flour of inferior quality. Three parts of the ground rootstock yields 1 pt. of pure tapioca. The material remaining after the manufacture of tapioca is sometimes dried and used for fuel.

The young leaves of certain varieties of cassava are used as pot herbs. The rootstock is eaten boiled or steamed. It is also sliced raw, dried in the sun for 1 or 2 days, and fried in cocoanut oil, being eaten with salt. Alcoholic beverages are made from the rootstock.—H. M. PIETERS.

Starch-yielding plants grown for food in the Antilles, A. PAIRAULT (*Bul. Assoc. Chim. Sucr. et Distill., 18 (1900–1901), No. 1–2, pp. 77–84*).—Descriptions and analyses are given of the following plants: Yams (*Dioscorea alata, D. trifida, D. tuberosa*), Brazil cabbage (*Xanthosma sagittifolium*), taro (*Caladium esculenta* or *Colocasia antiquorum*), banana (*Musa paradisiaca*), breadfruit (*Artocarpus incisa*), manioc cassava (*Manihot utilissima*), and sweet potatoes (*Ipomæa batatas*, or *Batatas edulis*). The percentage composition of the breadfruit follows: Water, 46.21; protein, 2.34; fat, 0.40; starch, 41.42; crude fiber, 4.20; ash, 1.78, and undetermined, 3.65.

Hibiscus esculentus [gumbo], A. ZEGA (*Chem. Ztg., 24 (1900), No. 81, p. 871, fig. 1*).—Analyses are reported.

Strong and weak flours, F. B. GUTHRIE (*Agr. Gaz. New South Wales, 11 (1900), No. 10, pp. 863–869*).—A general discussion of gluten and its relation to bread making.

Yeast as a food and food accessory and its examination under a pure-food law, S. ROHRER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 3 (1900), No. 11, pp. 756–763*).—The methods of examining yeast are described. The author insists that those in use are not satisfactory, and that a method fair to both manufacturer and consumer is needed.

The jam and marmalade industry and sugar consumption in England, P. DEGENER (*Arb. Deut. Landw. Gesell., 1900, No. 44, pp. 40; abs. in Ber. Deut. Bot. Gesell., 9 (1900), No. 8, pp. 390, 391*).—A descriptive article.

Concerning new food preparations, C. EHRMANN and K. KORNAUTH (*Ztschr. Untersuch. Nahr. u. Genussmtl., 3 (1900), No. 11, pp. 736–739*).—Investigations which

are described in detail show that such food preparations as somatose, meat extract, etc., are quite free from micro-organisms.

Diet of peasants, ROUXEL (*Jour. Hyg., 25 (1900), No. 1254, pp. 313-315*).—A general and descriptive article.

The digestibility of protein in bread, F. H. CURTISS (*Amer. Phys. Education Rev., 5 (1900), No. 3, pp. 221-234*).—In experiments in which the author himself was the subject he studied the digestibility of baker's and homemade bread, graham bread, and entire wheat bread, the time required for the digestibility of different sorts of bread being taken into account as well as the thoroughness of digestion.

The lecithin content of milk and its relation to the relative weight of the brain of nurslings, R. BUROW (*Ztschr. Physiol. Chem., 30 (1900), No. 6, pp. 459-519*).—Investigations on the lecithin content of milk and the brain, which the author believes indicate a relationship between the two.

The influence of acids on the amylolytic action of saliva, G. A. HANFORD (*Amer. Jour. Physiol., 4 (1900), No. 5, pp. 250-260*).—"The chief object of this note has been to point out that it is impossible to designate any percentage of acid or alkali which inhibits salivary digestion in a definite degree. The character of the action is dependent also upon the absolute amount of saliva and the attendant variation in the quantity of proteid matter present. Whenever free hydrochloric acid is present, inhibition—more or less complete—is certain to result."

A contribution to the subject of peptic digestion, H. MALFATTI (*Ztschr. Physiol. Chem., 31 (1900), No. 1-2, pp. 43-48*).—A brief account of experimental methods.

Note on the recent report of V. Henriques and C. Hansen on fat absorption, E. PFLÜGER (*Arch. Physiol. [Pflüger], 82 (1900), No. 7-8, pp. 381-383*).—A critical and controversial article.

The ability of soaps to dissolve colors soluble in fat, J. NERKING (*Arch. Physiol. [Pflüger], 82 (1900,) No. 9-10, pp. 538-540*).—A contribution to the subject of the digestibility of fat.

Contributions to the physiology of creatinin, I, A. GREGOR (*Ztschr. Physiol. Chem., 31 (1900), No. 1-2, pp. 98-118*).—The author thinks it probable that creatinin is the product of a specific muscle metabolism and represents the cleavage of material corresponding to muscular action.

Yield and preservation of agricultural feeding stuffs, C. BÖHMER (*Ernten und Conservirung der landwirtschaftlichen Futtermittel. Berlin: P. Parey, pp. 178, figs. 26; rev. in Ber. Deut. Bot. Gesell., 9 (1900), No. 5, pp. 397, 398*).—A handbook.

Analyses of fodders and feeding stuffs, F. G. BENEDICT (*Connecticut-Storrs Sta. Rpt. 1899, pp. 209-215*).—Analyses of a number of feeding stuffs are reported, including brome grass, meadow fescue, orchard grass, timothy, soy bean fodder, silage corn (Ohio white dent), stover of white flint corn, soy bean seed, and white flint corn kernels. Most of the materials were samples of crops grown in plat experiments conducted by the station for the purpose of studying the effects of different kinds and amounts of nitrogenous fertilizers upon the yield and composition of different crops (see pp. 1028).

Reports of inspectors of stock for year ended March 31, 1900, T. A. FRASER (*New Zealand Dept. Agr. Rpt. 1900, pp. 57-126, pls. 7*).—This contains the usual matter regarding live stock and brief notes on the subject from the different districts of New Zealand. Among other matters ostrich farming is described.

Experiments in sheep breeding, T. WINTER (*Agr. Gaz. [London], 52 (1900), No. 1398, p. 246*).—A brief account of cross-breeding experiments.

Information concerning the Angora goat, G. F. THOMPSON (*U. S. Dept. Agr., Bureau of Animal Industry Bul. 27, pp. 94, pls. 18, fig. 1*).—From a large number of sources the author has compiled information on the origin and history of Angora

goats, their use, places adapted to their culture, the care which they require, the building up and management of a flock, shearing and shedding, diseases, and other topics, including statistics.

Profitable production of lean bacon, J. M. HARRIS (*Jour. British Dairy Farmer's Assoc., 15 (1900), pt. 1, pp. 7-15*).—The requirements for the successful raising of pigs for bacon for the English market are discussed and experiments undertaken by the Wilts County Council and private enterprise are briefly reported. The author's summary follows:

"To produce at the greatest profit the best pigs for the production of prime quality lean bacon, the farmer is recommended: (1) To breed his pigs from Large Yorkshire Whites or from these and pure Berkshires; never from crossbreds. (2) To house his fatting pigs in dry, warm, well-ventilated styes which allow of easy cleaning. They should be placed, if possible, in a sheltered and sunny position. (3) For fattening, to soak the meal used in cold water, to use barley meal as the staple food, and to supplement this, as far as possible, by fresh, separated, skim, or buttermilk, at the rate of about 1 gal. per pig per day, and, when procurable, by boiled potatoes also, not more than 3 or 4 lbs. per pig per day.

"Where cheese is made, it would be well to supplement the barley meal and whey by about 1 lb. of bean or pea meal per pig per day.

"Where dairying is not carried on, bran, toppings, bean meal, or pea meal may be used with care as a substitute for milk; but the dairy farmer has undoubtedly a great advantage in the profitable production of the class of pig required for making the best quality lean bacon."

Pigs at the Hawkesbury Agricultural College, G. VALDER (*Agr. Gaz. New South Wales, 11 (1900), No. 10, pp. 870-877, pls. 7*).—A test on the comparative value of bacon breeds is reported, but definite conclusions are not drawn. Bacon curing is described.

Report of poultry division, D. D. HYDE (*New Zealand Dept. Agr. Rpt. 1900, pp. 264-275, figs. 9*).—The work of the division during the year is described briefly, and directions given for marketing poultry, etc.

Petits poussins ["broilers"], G. A. PALMER (*Jour. British Dairy Farmers' Assoc., 15 (1900), pt. 2, pp. 113-119*).—The raising of chickens for use as "broilers" has been practiced for centuries in Belgium and France, and the author describes the breeds used and the methods followed. Directions are also given for attractive dressing and marketing of this class of poultry.

DAIRY FARMING—DAIRYING.

The influence of feed and care on the individuality of cows, C. F. DOANE (*Maryland Sta. Bul. 69, pp. 31-60, pls. 7*).—Several years ago the station purchased a herd of grade cows to represent as nearly as possible the average dairy herd found in the State. The record of the cows as to history, feeding, and production previous to their purchase by the station was very incomplete. The attempt was made to increase the productive capacity of the individual cows in the herd by systematic feeding and good care extending over a number of years. The rations fed varied from time to time, and were not uniform for the herd. No attempt was made at forcing. All received the same care. Records of 10 of the cows by lactation periods for 2, 3, or 4 years are tabulated and discussed. Notes are given on the history and feeding of each. Illustrations from photographs are given

of 7 of the cows. The following table gives a summary of some of the data obtained:

Average record of grade dairy herd for several lactation periods.

Cow.	Lactation periods.	Record first period.			Maximum record any period.		
		Yield of milk.	Fat content of milk.	Yield of butter.	Yield of milk.	Fat content of milk.	Yield of butter.
	No.	*Pounds.*	*Per cent.*	*Pounds.*	*Pounds.*	*Per cent.*	*Pounds.*
No. 1	1	4,004	5.5	258.3	6,091	5.5	370.0
No. 2	4	3,461	4.7	190.3	4,729	5.1	269.9
No. 3	2	4,122	3.4	155.6	5,051	3.5	208.9
No. 4	3	5,192	3.5	215.4	6,163	3.6	257.1
No. 7	1	4,537	4.9	258.8	6,134	5.5	362.2
No. 9	2	5,114	4.5	267.0	5,114	4.5	267.0
No. 10	3	6,097	3.7	263.0	6,995	4.5	348.3
No. 15	1	4,035	3.8	182.9	7,995	4.3	359.2
No. 28	3	6,357	3.9	293.4	6,828	4.1	315.9
No. 29	3	4,653	4.9	264.4	5,465	5.0	321.2

The author discusses the results as showing the effect of feeding and care upon the development of the cows, noting in this connection results obtained at the New York Cornell Station in feeding grain to young cows on pasture (E. S. R., 2, p. 369).

"No very material results could be noticed the first year from the extra feed and care the herd received, but through subsequent years there seems to be a steady improvement. Judging from the records of these cows, it is a question if the quality of a dairy cow does not depend almost as much on the feeding as on the breeding. It is also a question if cows which have a more or less pronounced beef tendency, or at least would not be called good material from which to build up a dairy herd, can not with proper management be developed into profitable dairy cows."

The bacterial condition of city milk and the need of health authorities to prevent the sale of milk containing excessive numbers of bacteria, H. W. Park (*Science, n. ser., 8 (1901), No. 322, p. 322*).—During the coldest weather the milk supply of New York is said to average about 250,000 bacteria per cubic centimeter, during cool weather about 2,000,000, and during hot weather about 5,000,000. This does not apply to the specially-treated milks, which contain from 5,000 to 20,000 bacteria, according to the season. Regarding the harmfulness of these bacteria the author cites the universal clinical experience "that a great number of children in cities sicken on the milk supplied in summer; that those who are put on milk that is sterile or contains few bacteria, as a rule, mend rapidly, while those kept on the impure milk continue ill or die." The author questions whether in the present state of knowledge it is possible for health boards to set a limit to the number of bacteria which milk may contain and above which its sale should be prohibited; but he urges the importance of the authorities giving attention to this matter with a view to securing an improvement through the farmer and the middleman.

The vitality of pathogenic and other micro-organisms in milk, F. VALAGUSSA and C. ORTONA (*Ann. Ig. Sper.; abs. in Nature, 63 (1901), No. 1634, p. 404*).—The action of sunlight on bacteria in milk was investigated, and as was to be expected from the opacity of the liquid no deleterious effect was detected, except in the case of those varieties which live on the surface of liquids and were, therefore, not shielded from the sunshine. Another point of interest investigated was the effect of inoculation into milk upon the elaboration of toxins by the diphtheria bacillus. It was found that although this bacillus produced toxin when grown in milk, its strength was less than when grown in other culture media; moreover, a marked increase in the strength of the toxin was noted when the cultures were kept in a cool cellar instead of at the ordinary temperature of the laboratory. The exact thermal death point of the tubercle bacillus in milk was also reinvestigated, the authors concluding that exposure to temperatures of 60, 70, or 80° C. is insufficient to guarantee the destruction of this bacillus in milk. Milk freshly drawn from the cow, with precautions insuring its sterility, was found to afford a better culture medium for bacteria than after it had been artificially sterilized by heating to 100° C. A bibliography of the existing literature on the subject is appended to the article.

Pathogenic microbes in milk, E. KLEIN (*Jour. Hyg. [Cambridge], 1 (1901), No. 1, pp. 78–95*).—From an examination of 100 samples of milk from country dairies, 7 were found by inoculation tests to contain virulent tubercle bacilli; 8 samples contained *Bacillus pseudotuberculosis*. A series of observations carried out for the purpose of testing the viability of the tubercle bacillus in milk showed that this organism grows well in milk kept at a temperature of 37° C. In one sample of milk the tubercle bacillus of diphtheria was found, and proved to be virulent when inoculated into the guinea pig. *Bacterium diphtheroides* was also found in one sample.

From the secretion of diseased udders the author isolated a number of forms of streptococcus, which were found to vegetate readily on the surface of the gelatin and also in milk at a temperature of 37° C. In 1 sample a pathogenic yeast was found, apparently differing in cultural and physiological characteristics from the torula which had previously been obtained from human cancer. When inoculated into guinea pigs, it produced unusually large tumors. The organism developed well on gelatin, alkaline agar, blood serum, and in milk.

The distribution of the tubercle bacillus and pseudo-tubercle bacillus in milk, and the biology of the tubercle bacillus, E. KLEIN (*Centbl. Bakt. u. Par., 1. Abt., 28 (1900), No. 4–5, pp. 111–114*).—The author made an examination of 100 samples of milk from the London market in the condition in which it is received from the surrounding

country. The milk was allowed to stand in an ice chest for from 20 to 24 hours. This method was found to be as satisfactory for getting rid of foreign bodies as that of the centrifuge. Two forms of bacteria were found in the milk samples, one resembling in all respects the tubercle bacillus and being acid proof, the other form being too short and thick for the true tubercle bacillus. The latter form of bacillus did not produce tuberculosis when injected into experimental animals. It was found by experiments that the virulence of the tubercle bacillus may be considerably increased by repeated culture in milk. Cultures of tubercle bacillus which the author had maintained upon glycerin agar for 12 years were inoculated in milk, with the result that within a week clumps of developing bacilli were noticed with the characteristic appearance of the tubercle bacillus. Guinea pigs inoculated with this culture developed true cases of tuberculosis.

Experiments with pasteurizing apparatus, 1900, V. Storch, P. V. F. Petersen, and L. C. Nielsen (*47. Rpt. Kgl. Vet. Landbohöjskoles Lab. Landokon. Forsög* [*Copenhagen*], *1900, pp. 64*).—The main part of this report is given up to an account of the working, under ordinary creamery conditions, and tests of the maximum capacity, of 3 different forms of pasteurizing apparatus made by Danish manufacturers in accordance with suggestions laid down in a previous report of this station (E. S. R., 11, p. 887).

The results show in general that the apparatus satisfactorily meets the requirements of modern Danish creameries. A table is worked out showing the amount of heating surface required to raise 10,000 lbs. of milk per hour 1° C. from 0 to 99°. The trials made show that an apparatus constructed according to the principles explained in the report, which has a heating surface of 15,000 sq. cm., will raise 11,200 lbs. (Danish) of milk per hour from 40 to 85° C., which has been estimated to be a saving of about 40 per cent in steam consumption over that required by the older forms of pasteurizing apparatus.

Destroying foam in centrifugal skimming.—In skimming milk by the centrifugal process foam may be formed in three places, in the cream separator, in the skim milk pump, and in the older forms of pasteurizing apparatus. From observations made in the earlier investigations it seemed likely that the improved pasteurization apparatus might act as a foam destroyer, and further trials showed that after certain changes were made in the apparatus it acted satisfactorily in this respect. If the weight of the foamless milk be assumed to equal 1, the milk as received from the separators in one series of trials weighed on the average 0.71, and from the skim milk pump 0.65, while milk drawn from different heights of the pasteurizing apparatus (from below upward) weighed 0.90, 0.95, 0.97, 0.98, and at the outflow of the apparatus, 0.94. In another apparatus tried the following

average figures were obtained: From separator, 0.72; from skim milk, 0.62; from different parts of the apparatus, 0.88, 0.96, 0.97, and 0.98, and at the outflow, 0.97.

Keeping trials with pasteurized skim milk.—The keeping qualities of skim milk pasteurized at 85 to 88° C. and at 97 to 99° C. were determined in a number of trials, and comparisons made with raw skim milk. The milk was cooled to different temperatures or treated in different ways after the heating. The samples were kept in stoppered bottles at ordinary room temperature, and the time noted when the milk could still be boiled without curdling. The average results are given in the table below, the second column showing those for 3 creameries and the third those at one other:

Length of time skim milk kept after pasteurizing.

	When heated to 85–88°.	When heated to 97–99°.
	Hours.	*Hours.*
Raw skim milk pasteurized at 40° C	12	11
Pasteurized skim milk direct from separator	59	59
Pasteurized skim milk cooled to 50° C. and sampled	48	48
Pasteurized skim milk cooled to 50° C., poured in milk can, and sampled	24	25
Pasteurized skim milk poured directly into milk can and sampled	55	60
Pasteurized skim milk cooled to 10° C. and sampled	51	50
Pasteurized skim milk cooled to 10° C., poured into milk can, and sampled	31	28
Pasteurized skim milk poured directly into milk can and sampled	56	60

The results show that the easiest way to sterilize transportation cans is to fill them with the milk at the temperature of pasteurization (85° C. or above), an 80-lb. can of milk cooling only 2 to 3 degrees if the can is filled full, and 4 to 5 degrees if only half filled; and that cooled pasteurized milk can not safely be kept in nonsterilized transportation cans.—F. W. WOLL.

A view of the present state of the dairy industry in Russia, P. PAKHOMOFF (*Soc. Imp. Agr. Moscow, 1900, pp. 50, figs. 6*).—A publication issued for distribution at the Paris Exposition of 1900.

Science in relation to dairying in New South Wales, M. A. O'CALLAGHAN (*Agr. Gaz. New South Wales, 12 (1901), No. 1, pp. 139–143, figs. 3*).—A history of the progress of dairying in the section indicated.

Development of the dairy cow, C. S. PHELPS (*New York Produce Rev. and Amer. Creamery, 14 (1901), No. 30, pp. 26–31*).—An address before the Connecticut Dairymen's Association.

An experimental milk supply, W. ROBERTSON (*Public Health, 13 (1901), No. 6, pp. 412–421*).—A paper read before the Society of Medical Officers of Glasgow, Scotland, concerning the results reached by the methods employed in improving the city milk supply.

The composition of Indian cows' and buffaloes' milk, J. W. LEATHER (*Analyst, 26 (1901), No. 299, pp. 40–42*).—The fat content of the cows' milk was high, varying from 4 to 6 per cent. That of buffaloes' milk was very high, 7 and 8 per cent being common. Butter from the cows' milk was very pale yellow; from the buffaloes' milk, quite white.

Variations produced in the acidity of milk by heating, H. Höft (*Milch Ztg., 30 (1901), No. 7, p. 103*).—By heating milk from 50° C. to boiling the acidity was reduced from 4 to 10 per cent. The amount reduced was variable but in general increased with the degree of heat applied.

Goats' milk, T. Zamitt (*Rev. Internat. Falsif., 12 (1899), pp. 44, 45; abs. in Jahresber. Thier Chem., 29 (1899), p. 241*).—An average analysis of the milk of goats on the Island of Malta shows specific gravity 1.032, fat 5 per cent, ash 0.89 per cent, dry matter, including fat, 15 per cent.

Artificial milk, Marsac (*Ind. Lait., 26 (1901), No. 5, pp. 35, 36*).—The chemical and mechanical means of rendering cows' milk more like human milk in composition are described, and the employment of such milk in feeding children is discussed.

Destroying tubercle bacilli in milk, Morgenroth (*Hyg. Rundschau, 10 (1900), pp. 865–868; abs. in Chem. Centbl., 72 (1901), I, No. 2, p. 128*).—By experiments it was found that milk infected with tubercle bacilli was rendered sterile by heating to 70° C. for from 10 to 30 minutes, or to 100° C. for from 3 to 5 minutes. After heating, the milk was cooled quickly. The same result was attained by keeping the milk at a temperature of 55° for 3 hours. Keeping it at that temperature for 2 hours did not render the milk sterile.

Classification of dairy bacteria, H. W. Conn (*Connecticut Storrs Sta. Rpt. 1899, pp. 13–68*).—Detailed descriptions, including morphology and cultural and biochemical characteristics, are given of over 100 species of bacteria isolated by the author from dairy products during the last 10 years, together with an account of the collection of the bacteria, methods of isolation and study, and the classification and naming of the species. The bacteria are arranged in 10 groups, and tables devised for the rapid identification of the species are given. The species or groups of closely related forms most commonly found were *Bacillus acidi lactici*, *B. lactis aerogenes*, and *Micrococcus lactis varians*. A list of references upon systematic bacteriology with special reference to dairy species is given.

Inspection of Babcock milk-test bottles, W. H. Jordan and G. A. Smith (*New York State Sta. Bul. 178, pp. 97–103*).—The New York law relative to the testing of bottles used in the Babcock test at creameries and cheese factories is given and briefly discussed. The method followed at the station in the testing of the bottles is given. Of 2,259 bottles tested, 76 were rejected. A list of creameries and individuals sending bottles for examination in compliance with the law is given.

The volatile fatty acid content of Netherlands butter, L. T. Reicher (*Ztschr. Angew. Chem., 14 (1901), No. 6, pp. 125–128*).—Analyses showing the Reichert-Meissl number of butters examined covering several years.

Making sweet-cream butter (*New York Produce Rev. and Amer. Creamery, 14 (1901), No. 29, pp. 10–14*).—Reports from dairymen and others on the making and marketing of butter from sweet cream.

The Belgium law covering the manufacture and sale of oleomargarine, J. Wauters (*Bul. Assoc. Belge Chim., 14 (1900), No. 11–12, pp. 453–475*).—A reprint of the law, and comments covering some results of analysis of butter and butter substitutes in Belgium.

The chemical changes in the manufacture and ripening of cheese, J. R. Green (*Jour. Roy. Agr. Soc. England, 3. ser., 11 (1900), pt. 4, pp. 674–693*).—This is a résumé of the subject of the ripening of cheese, including the changes which take place and the modern views regarding the causes of these changes, development of special flavors, etc.

Changes in the fat during the ripening of soft cheeses, G. Fascetti (*Staz. Sper. Agr. Ital., 33 (1900), No. 5, pp. 430–435*).—The changes that occur in the fat during the ripening of soft cheeses consist largely in the formation of soluble fatty acids. These changes are more pronounced in pure cheese than in filled cheese.

Melun cheese, A. VIVIEN (*Ind. Lait.*, *26* (*1901*), *No. 6*, *pp. 43–45*).—A description of melun cheese, together with methods of manufacture and analyses of the product.

Cheese from goat milk, B. C. BUFFUM (*Amer. Agr.*, *67* (*1901*), *No. 12*, *p. 361*).—The present progress and the possibilities of the manufacture of cheese from the milk of goats.

Making cheese from heated milk, J. KLEIN and A. KIRSTEN (*Milch Ztg.*, *30* (*1901*), *No. 3*, *pp. 35–37*).—In the experiments of making cheese from milk heated to 90° C. the curd and cheese secured was greater than with milk not heated, owing to a higher whey content.

VETERINARY SCIENCE AND PRACTICE.

Leucocytosis in experimental infections, E. SCHLESIGNER (*Ztschr. Hyg. u. Infectionskrank.*, *35* (*1900*), *No. 3*, *pp. 349–419*).—This article contains a detailed account of a large number of experiments made by the author for the purpose of determining the effect of hypodermic inoculations of various pathogenic bacteria upon the number of the leucocytes. Among the bacteria with which experiments were made may be mentioned the organisms of pneumonia, diphtheria, anthrax, and tetanus. The total number of leucocytes and the relation of the polynuclear cells to the lymphocytes was found to vary exceedingly in rabbits. The number of white blood corpuscles varied from 1,000 to 2,000 per cubic centimeter in health. A reduction of the number of leucocytes after hypodermic injections was noted in only one case, after about 4 hours. It was found that the appearance, intensity, and duration of hypoleucocytosis were variable, and that there was no relationship between this process and the quantity or virulence of the bacterial culture. In the process of leucocytosis the lymphocytes were most affected, while the polynuclear cells were only slightly decreased in number. A hyperleucocytosis was often the only symptom upon inoculation. In cases in which recovery took place the hyperleucocytosis reached its maximum on the second or third day, and the number of leucocytes decreased to the normal very rapidly. In fatal cases the behavior of the white blood corpuscles was extremely variable.

In inoculations of anthrax cultures, leucocytosis exhibited two phases, one in which the number of white blood corpuscles was slightly decreased in cases which finally recovered, and somewhat increased in fatal cases, and the second phase in which there was a great increase in the number of white blood corpuscles in fatal cases and a slight increase in convalescent cases. In immunizing experiments with anthrax it was found that after the first injection of anthrax vaccine a rather marked hyperleucocytosis took place.

The relative susceptibility of the domestic animals to the contagia of human and bovine tuberculosis, R. R. DINWIDDIE (*Arkansas Sta. Bul. 63*, *pp. 37–65*).—In this bulletin the author gives the results of further experiments along the same line as those reported in

Bulletin 57 of the Arkansas Station (E. S. R., 11, pp., 689–691). In the previous experiments he used a crude tubercular material of human and bovine origin, while in the present tests pure cultures of the tubercle bacillus from these 2 sources were used for inoculation purposes. During these experiments 10 cultures, 6 of bovine origin and 4 of human origin, were employed, 8 or more cattle, sheep, and pigs being subjected to the test. The cultures were in all instances isolated by a preliminary passage through the guinea pig. As the culture medium the author used 6 per cent glycerin beef serum, coagulated and sterilized at temperatures from 80° to 90° C. In sheep and pigs inoculations were made in the body cavity. In cattle the inoculations were made in this manner, and also directly into the substance of the lungs. Seven calves, ranging in age from 2 to 17 months, were inoculated with sputum cultures, 5 in the body cavity, 1 in the lung, and 1 in the trachea. None of these animals suffered from any striking impairment of health during periods of from 5 to 18 months, when they were under observation. Three failed to respond to the tuberculin test, 1 gave a doubtful reaction, and 3 responded positively. The reaction to the tuberculin test disappeared in all the calves within 4½ months after inoculation. In 2 cases the animals were reinoculated with bovine cultures 1 year after receiving sputum cultures. Post-mortem examinations showed conclusively that the numerous tubercles were of recent origin, and had been caused by the recent inoculations. These experiments indicated that repeated injections of tuberculin and previous inoculations with sputum cultures had no immunizing effect, and that the sputum cultures apparently produced only a temporary form of the disease. The author believes that whatever may be determined the most common means of natural infection in cattle, unsanitary surroundings are in nearly all cases of great importance.

The author used 6 sheep in determining the effect of sputum cultures on these animals. The sheep which survived were kept for about a year and examined, after having given a positive reaction to tuberculin. Similar inoculations were made on sheep with bovine cultures. The results obtained from these comparative tests were similar to those obtained with cattle, with the exception that the sheep exhibited a rather high degree of susceptibility to tuberculosis produced by inoculation.

In previous experiments on pigs, no excess of virulence of the bovine tubercle over that of man was noted. In comparative tests with pure cultures, the difference in the effects of the sputum and bovine cultures were almost as well marked as in the case of sheep.

The general results of these experiments may be summarized as follows: Pigs, sheep, and cattle possess a varying degree of susceptibility to tubercle bacillus of human origin, cattle being most resistant and pigs least so. In pigs only were genuine cases of chronic tuberculosis developed by inoculation with human tubercular material.

Sheep were found to be somewhat more susceptible than cattle, as evidenced by the larger lesions and the permanence of the tuberculin reaction. All three species were found to be highly susceptible to cultures of bovine origin. In the case of cats, only two were tested. The effects were about the same, being slight in either case. The susceptibility to tuberculosis produced by inoculation in the domestic animals does not correspond strictly to the extent of the naturally acquired disease. Among the other factors which may be important in determining this matter, the author attributes weight to the bad ventilation in stables.

Tuberculous cows and the use of their milk in feeding calves, C. S. PHELPS (*Connecticut Storrs Sta. Rpt. 1899, pp. 150–167*).—The author continued experiments with 4 cows upon which a report has been previously noted (E. S. R., 11, pp. 890, 891). These cows had been under observation for 3½ years. Detailed statistics concerning the history of the cows and of the calves which were fed upon their milk are presented in tabular form. One of these cows gave no reaction to the tuberculin test since January, 1897, a period of 3½ years. The second cow responded to the test in December, 1899, but failed to respond on March 20, 1900. The third cow showed a reaction in June, 1899, but did not respond when tested in December, 1899, and on March 20, 1900. The fourth cow failed to respond to tests which were given in the years 1899 and 1900.

During a greater portion of the 3½ years, the milk from the 4 tuberculous cows was fed to calves. In some cases the calves were fed until they were a year or more of age; and in most of the experiments they were confined in the same stable with the cows and exposed to the contraction of tuberculosis by ordinary contagion. A detailed history is given of each feeding experiment, the general results of which may be summarized as follows:

During the first 2 years only 1 secondary case of tuberculosis developed. This case appeared about 25 months after the cows were purchased. During this time 4 animals were fed from the milk of the cows for periods ranging from 12 to 18 months. At the same time the experimental calves were closely associated with the cows. The experience of the first 2 years indicated, therefore, that when tuberculosis exists in a cow in its incipient stages, the liability of its transmission by milk or otherwise to calves which are associated with the cows is quite limited. During the succeeding year and a half different results were obtained. From August, 15, 1898, to March 20, 1900, 5 animals were fed upon the milk of these cows, and all 5 contracted tuberculosis. Two of these cases developed in calves 3 months old, and the other 3 in calves from 12 to 18 months old. The physical condition of the cows indicated that the disease had become much more generalized, at least in 3 cases.

During the first 2 years it was impossible to diagnose tuberculosis in the cows by physical symptoms, except doubtfully in one case. During the following year and a half, however, physical examination gave good evidence of the disease in 3 out of the 4 cows. The fact that no case of tuberculosis appeared in the calves until they had been fed upon the milk of these cows for from 1 to 1½ years, and had been almost constantly associated with them, indicates that there is little danger from the transmission of tuberculosis during its earlier stages.

Serum diagnosis of tuberculosis in cattle, S. Arloing (*Jour. Méd. Vét. et Zootech., 5. ser., 4 (1900), pp. 449–458*). The author conducted 3 series of experiments for the purpose of determining the action of blood serum in agglutinating quantities of tubercle bacillus. In the first series the serum was prepared from the blood of calves, in the second from the blood of healthy cattle, and in the third from the blood of adult tuberculous cattle. In the first series of experiments the blood of 30 calves was tested with reference to its agglutinating power; the calves were from 5 to 8 weeks old. From none of the calves was a serum obtained which would agglutinate quantities of tubercle bacillus, even in the proportion of 1 drop of the serum to 2 drops of the culture. In the second series of experiments 50 adult cattle were utilized, from which serum was prepared and mixed with homogeneous cultures of the tubercle bacillus, in the proportions of 1 to 5 and 1 to 10. In no case did the serum produce agglutination in the proportion of 1 to 10, while in the proportion of 1 to 5 the serum from 24 out of 50 subjects had a more or less pronounced agglutinating effect. In the third series of experiments the author studied the serum of 70 tuberculous cattle. Of this number of experimental animals 69 furnished a blood serum with agglutinating power when mixed with quantities of the tubercle bacillus in the proportions of 1 to 10 and 1 to 20. In the remaining cases the agglutinating power was not pronounced in mixtures of 1 to 5. The author attempted to determine whether there was a definite relation between the intensity of the agglutinating power and the extent of the tubercular infection. Such relation was not apparent. From these experiments it is concluded that, as a general rule, the blood serum of a tuberculous animal has the power of agglutinating the tubercle bacillus in homogeneous cultures in the proportion of 1 to 10. An animal of which the blood has such power may therefore be considered tuberculous. This test may be used in checking the results from tuberculin tests and may also be applied independently.

The hereditary transmission of tuberculosis through the placenta, G. d'Arrigo (*Centbl. Bakt. u. Par., 1. Abt., 28 (1900), No. 20, pp. 683–691*).—In order to secure evidence of the hereditary transmission of tuberculosis, the author conducted two series of experiments, in one of which guinea pigs were allowed to become pregnant after

inoculation with tubercle bacillus, while in the other series the guinea pigs were inoculated during pregnancy. The results obtained may be summarized as follows:

Guinea pigs which became pregnant during the process of tuberculosis, aborted in only a few cases. In the placenta and fœtus of guinea pigs which were killed on the sixteenth day of pregnancy, tubercle spores and bacilli were found in various lesions. From the location of these lesions it would appear that the tubercle bacillus made its way through the placenta from the blood of the mother and was enabled to establish itself in the tissue of the fœtus only after the lesions had been produced by the circulating tuberculin of maternal origin. In the young of tuberculous guinea pigs, pathological lesions were found rather abundantly, especially in the liver. The young animals soon became emaciated and died ultimately of tuberculosis. A bibliography of the subject is appended to the article.

Experimental tubercular mammitis in cows and goats during lactation, E. NOCARD (*Rec. Méd. Vét., Paris, 8. ser., 7 (1900), No. 23, pp. 721–727*).—It had already been determined that inoculation of anthrax cultures into the milk sinus produces death within a few days and that a similar inoculation in animals which had been previously vaccinated against anthrax did not produce the disease in such animals; but it was observed that the anthrax bacillus persisted indefinitely in the milk ducts in a virulent form, and that ultimately the animal succumbed to toxins produced by these bacilli. The author had, therefore, already established the possibility of the persistence and multiplication of bacilli in the secretions of an animal which was perfectly immunized against the bacillus. The absence of an antitoxic power of an immunized organism was also noted. In the experiments with the tubercle bacillus, the author made use of a cow and a goat in the period of lactation. For producing inoculation it was found sufficient to inject a small quantity of a virulent culture of the tubercle bacillus in such a manner as not to produce any lesion of the mucous membrane. A tubercular mammitis of rapid course was produced and death resulted within a few weeks. A study of these cases, however, demonstrated that death was the result of intoxication, not of a generalization of tuberculosis. A high temperature was shown in both the cow and goat, being from 40 to 41° C. in the former and 40 to 42° in the latter.

The author concludes from his experiments that the active mammary gland is the most favorable of all living tissues as a culture medium for tubercle bacillus and that for studying tubercular intoxication it is sufficient to make inoculations into the teat of an active mammary gland.

The diagnosis of anthrax and the destruction of anthrax carcasses, MEYER (*Berlin. Thierärztl. Wchnschr., 1900, No. 49, pp. 579–582*).—In a series of observations on the reliability of various

methods for diagnosing anthrax, the author found that the bacteriological method and the microscopical method of recognizing the anthrax bacillus in the blood are rendered difficult when the anthrax carcass is allowed to decompose to some extent before the examination is made. In order that the microscopical examination of the blood may be reliable, such examination should be made immediately after death. In the hands of experienced practicing veterinarians, mistakes in the diagnosis of anthrax are perhaps seldom made from judging external symptoms; but in order that the diagnosis should be certain, the author believes that a microscopical examination of the blood should be required by law. It is recognized that the difficulties of preventing the spread of anthrax are increased after opening the bodies of dead animals. Detailed directions are therefore given for the destruction of such carcasses.

Experimental researches on symptomatic anthrax; immunization, E. Leclainche and H. Vallée (*Ann. Inst. Pasteur, 14 (1900), No. 8, pp. 513–534*).—The author conducted experiments in the immunization of animals against this disease according to three different methods—inoculation with virus vaccine, pure cultures, and immunizing serum. It had already been shown that inoculation with cultures of *Bacterium chauvæi* heated for 2 or 3 hours to a temperature of 80 to 85° C. did not kill the experimental animals. The virus vaccine of Lyon is prepared from virulent fluid collected from the tumors of infected animals. This fluid when desiccated at a temperature of 37° C. gives a brown powder which incloses virulent spores. One part of the powder is then mixed with two parts of water and the vaccine for the first inoculation is obtained by heating for 7 hours at a temperature of 100 to 104° C. The vaccine for the second inoculation is obtained by heating at a temperature of 90 to 94° C. for the same length of time.

The tumors of infected animals occasionally contain other organisms beside that of symptomatic anthrax. In order to prepare pure vaccines it is necessary to make use of blood drawn from the heart or large vessels immediately after death. In the use of pure vaccines it was found that a vaccine obtained by heating to a temperature of 102° may be inoculated in young guinea pigs in doses of 0.05 gm. without producing death. The vaccine obtained by heating to a temperature of 92° C. killed guinea pigs when inoculated in the same sized doses. Cattle which were inoculated with heated cultures acquired an immunity which enabled them to resist subsequent inoculation with virulent cultures in doses of 0.02 gm. Animals which were inoculated successively with heated and nonheated cultures were found to possess complete immunity. Nine days after intramuscular inoculation of virulent fluid from infected animals, it was impossible to note any reaction, while the check animal died within 36 hours.

The authors conclude from their experiments that powdered vaccines prepared according to Arloing and Cornevin are not attenuated,

and that they contain unmodified spores. Their special properties are supposed to be due to an alteration of the toxin under the influence of heat. It was found possible to prepare pure powdered vaccines. Vaccination of cattle may be effected by the use of pure cultures heated to a temperature of 70° C. for 2 hours. The partial immunity thus produced may be completed by inoculation with a pure culture which has not been subjected to heat. Animals thus treated resist large doses of virulent fluid without reaction. This method has the advantage of being convenient and practical. The horse and goat treated with repeated intravenous injections of virulent fluid or pure cultures produce an immunizing serum which is possessed of preventive properties. It confers only a temporary immunity, and when mixed with virus, neutralizes the effects of the latter without producing permanent immunity.

Practical experience in vaccination against hog cholera, GRAUL (*Berlin. Thierärztl. Wchnschr., 1900, No. 49, pp. 577-579*).—In the present article, the author confines his attention to the three problems concerning the duration of immunity, indemnity for loss caused by inoculation, and inoculation by stock owners. According to the author's observations, the period of immunity produced by ordinary inoculation methods does not extend beyond 6 or 7 months. It is thought desirable, if possible, to bring about an immunity which will endure for a full year. In some instances, losses occurred as a direct result of preventive inoculation. The author believes that the question of indemnity for such losses must ultimately be regulated in a legal manner. On the question as to whether untrained individuals shall be allowed to inoculate animals, the author takes the position that this is very undesirable. Trained veterinarians are sufficiently numerous in all localities to be readily secured for this work in cases of emergency, and far better and more satisfactory results are obtained when such persons are engaged for the work than when inoculation is left in the hands of more or less irresponsible individuals.

Preventive and curative inoculations against hog cholera, T. KITT (*Monatsh. Prakt. Thierh., 12 (1901), No. 2-3, pp. 87-100*). The author presents a critical historical account of the various methods which have been adopted in producing immunity against this disease. It is stated that Susserin brings about a cure for hog cholera in many cases, and that when inoculated for protective purposes an effective immunity is produced. The use of attenuated pure cultures of hog-cholera bacillus for producing immunity against the disease is safe only in the hands of trained veterinarians. The substance known as Porcosan has been placed on the market with claims for its power in producing immunity against hog cholera. It was found, however, to contain living hog-cholera bacilli, and is therefore not to be recommended.

The glanders bacillus and glanders tubercle, G. Mayer (*Centbl. Bakt. u. Par., 1. Abt., 28 (1900), No. 20. pp. 673-683, pl. 1*).—The author presents a critical historical review of the literature relating to the structure of the glanders bacillus and the tubercles formed by its action. During his experiments pure cultures of glanders bacillus were injected into the body cavity of guinea pigs. It was found that the floating portion of such cultures could not be relied upon to produce acute cases of glanders. In order to accomplish this it was necessary to employ cultures from agar bouillon, rubbed up in a mortar with sterile butter. After inoculation with material prepared in this way death occurred within from 18 to 42 hours in the case of the most virulent cultures and after from 4 to 11 days in the case of less virulent cultures. In isolated specimens of the glanders bacillus, club-shaped swellings were observed at either end. In clusters of the bacillus club forms were more abundant on rods which occupied a peripheral position. The general appearance and the behavior of the bacillus were the same as in the case of streptothrix. The glanders bacillus was observed to penetrate into the lymphatic vessels and mesenteries. After escaping from the body cavity the bacilli made their way at once into the lymph cavities. In some animals an extensive accumulation of wandering cells was observed in the spleen. Tubercles produced by the glanders bacillus were characterized by the rapid accumulation of such cells, which soon became very similar to epithelial cells. After the formation of such tubercles the tissue is rapidly broken down by the action of the glanders toxin.

Experimental aspergillosis, T. A. Rothwell (*Jour. Path. and Bact., 7 (1900), No. 1, pp. 34-52, pl. 1, figs. 4*).—Intraperitoneal, subcutaneous, and dermic inoculations of *Aspergillus niger* and *A. fumigatus* were made by the author in guinea pigs and rabbits. The detailed results of these experiments were tabulated for the purpose of comparison. The majority of experiments were made by means of intraperitoneal injections, this method being considered preferable to intravenous injections on account of the possibility of producing embolism by the latter method. The results of such inoculations consisted essentially in the formation of tubercles of various sizes in different organs. The tubercles consisted in the proliferation of the connective tissue cells which ultimately gave rise to small translucent bodies. During the later stages of development of these tubercles, there was a noticeable infiltration of polynuclear leucocytes. Both species of Aspergillus were found to be capable of producing lesions which resembled one another, but injections of *A. fumigatus* caused death while those of *A. niger* did not. Both organisms were shown to be capable of germinating in the living tissues. *A. fumigatus* is considered more pathogenic than *A. niger*.

Investigation of diseases in poultry, E. F. PERNOT (*Oregon Sta. Bul. 64, pp. 24, figs. 4*).—The author made a study of avian tuberculosis in poultry. Experiments in inoculating guinea pigs with tuberculous material from the intestines and liver of a diseased hen gave negative results. In one case where 6 hens died of tuberculosis one was examined and found affected with a generalized form of the disease. The digestive tract was evidently the original focus of infection in this case, as shown by the numerous tubercles in the intestinal walls. These tubercles ultimately break down, and the disease may therefore be spread in the intestinal passages. It is recommended that all fowls which die of tuberculosis should be deeply buried or burned. The author studied also one case of tuberculosis of a hen's leg.

In the treatment of catarrhal roup, the author obtained good results from the use of a 2 per cent solution of permanganate of potash and water. In administering this treatment the head of the fowl was plunged into the solution and held there for a short time. The result of this immersion is ordinarily violent sneezing, which forces the solution through the nasal passages. The same solution may be diluted with 4 times its bulk of water and given to the fowls to drink.

Favus of fowls may be treated by removing the scales from affected birds and applying an ointment made of vaseline and 2 per cent carbolic acid. The treatment recommended for scabies of poultry consists in removing loosened scales by soaking in warm water and soap and the subsequent application of an ointment made of balsam of Peru, at the rate of 1 or 2 drams to 1 oz. of vaseline.

The author reports serious losses among young chickens, especially incubator chickens, from pneumonia and congestion of the lungs. These diseases were apparently brought about from overcrowding in the brooders and from exposure to cold when allowed to come out of the brooder houses. As a remedy for this difficulty, the author recommends any device which will prevent the young chickens from huddling too closely together and becoming overheated. In one instance, where a device of this kind was used, 99 per cent of the chickens were raised. A rather heavy loss of incubator chickens was occasioned in some parts of the State by indigestion, due to improper feeding and to feeding too soon after hatching.

Tetanus, E. MATHEWS (*Jour. Comp. Med. and Vet. Arch., 21 (1900), No. 12, pp. 741-745*).—The author treated 4 cases of tetanus by hypodermic injections of woorara with good results in 2 cases, while in the other 2 cases the quality of the drug was believed to be inferior.

The source of tuberculosis in farm animals, R. R. DINWIDDIE (*Arkansas Sta. Bul. 63, popular ed., pp. 69-73*).—A brief popular form of Bulletin 63 (p. 1084).

The value of serum reactions for the early diagnosis of tuberculosis, S. ARLOING and P. COURMONT (*Deut. Med. Wchnschr., 26 (1900), No. 48, pp. 766-769*).—This article contains a report of observations on the agglutinating power of blood

serum from tuberculous patients. A more or less marked agglutination was produced by mixtures of such serum in proportions varying from 1 to 5, to 1 to 20. The most marked agglutination was produced from serum from incipient cases of tuberculosis.

Condemning tuberculous animals, G. Mazzini (*Gior. R. Soc. Accad. Vet. Ital., 49 (1900), No. 49, pp. 1165–1168*).—Brief suggestions on the extent to which tuberculous animals should be destroyed.

Tuberculosis in dogs, G. Petit and J. Basset (*Rec. Méd. Vét., Paris, 8. ser., 8 (1901), No. 1, pp. 5–13*).—This article contains detailed statements of the post-mortem findings in dogs which died of tuberculosis. The authors found evidence of tubercular pleurisy and pericarditis. The liver and kidneys were frequently affected. In the lungs the tubercles ultimately degenerated, leaving a cavity without caseous formation.

The leucocytes in tuberculosis, C. Achard and M. Loeper (*Compt. Rend. Soc. Biol. Paris, 52 (1900), No. 39, pp. 1066, 1067*).—In cases of tubercular arthritis the authors found in the serum a predominance of the lymphoid elements, there being 96 lymphocytes, 4 mononuclear, and 2 polynuclear elements to the 100 elements. When tubercular arthritis was produced experimentally, a temporary phase of increase in the number of polynuclear elements was noted, but the mononuclear elements ultimately became much more numerous. The same conditions were found to prevail in cases of generalized tuberculosis produced experimentally by intravenous inoculations.

Results obtained from inoculation against Texas fever, Scheibel (*Monatsh. Prakt. Thierh., 12 (1901), No. 2–3, pp. 108–121*).—The author presents in a brief form the re ults thus far obtained by different investigators in producing immunity against this disease. A bibliography of the subject is appended to the article.

Report of 10 cases of parturient paresis treated by potassium iodid, G. H. Roberts (*Indiana State Bd. Agr. Rpt., 49 (1899–1900), pp. 699–701*).—The author tabulates the history of these cases, in which the Schmidt treatment was adopted. Three of the cases died, while the other 7 recovered.

Measures to be adopted in controlling foot-and-mouth disease, J. Dupuy (*Bul. Min. Agr. [France], 19 (1900), No. 2, pp. 183, 184*).—It is reported that foot-and-mouth disease occurred during the past year in an epizootic form of unusual severity. The present article is in the nature of a circular stating the sanitary measures which promise to give the best results in controlling the disease.

Foot rot in sheep, G. C. Bellinger (*Agr. Gaz. New South Wales, 11 (1900), No. 12, pp. 1118, 1119*).—Brief notes on the nature and cause of this disease. An abundance of wet grass is believed by the author to be conducive to a somewhat troublesome form of foot rot.

Hog cholera and its treatment, G. d'Utra (*Bol. Agr. São Paulo, 1. s r., 1900, No. 5, pp. 318–331*).—The author gives a brief account of the geographical distribution of this disease, together with a discussion of the various names by which it is known in different countries. The different forms are described by means of the symptoms and pathological lesions. Preventive vaccination is recommended as the only means of successfully combating the disease.

Hog cholera cure (*Indiana State Bd. Agr. Rpt., 49 (1899–1900), pp. 336, 337*).—A brief popular account on the worthlessness of patent medicines in the treatment of this disease and the practical hygienic measures which should be adopted.

Combating swine plague and hog cholera, Schreiber (*Berlin. Thierärztl. Wchnschr., 1900, No. 50, pp. 589–593*).—The author conducted experiments for the purpose of determining whether these two diseases could be produced experimentally at will, and also to determine the relationship of the diseases to each other. Experiments were made on young pigs from 4 to 10 weeks old. These experiments indicated that both swine plague and hog cholera may be produced by intrathoracic and intraperitoneal inoculations and also by feeding with diseased tissue. The author

was unable to produce either hog cholera or swine plague by subcutaneous injections of virulent pure cultures. It was also found that hogs which had recovered from hog cholera possessed no immunity from swine plague; or where such immunity was observed, it was of only short duration.

Dourine of horses, J. Marek (*Ztschr. Thiermed., 4 (1900), No. 6, pp. 401–443, figs. 8*).—The author made extended studies of the pathological lesions produced by this disease. Especial attention was given to the brain, spinal cord, and spinal nerves. These studies failed to show any trace of an inflammatory process in any part of the central nervous system. In the posterior columns of the spinal cord a secondary degeneration of nervous tissue was noted. In long-standing cases certain pathological changes were noticed in the peripheral nerves and in the spinal cord, but it is believed that these changes could not be the cause of the symptoms usually observed in cases of dourine.

Malignant œdema in horses, Fröhner (*Monatsh. Prakt. Thierh., 12 (1901), No. 2–3, pp. 100–103*).—The author gives a detailed account of the symptoms and post-mortem findings in this disease in horses.

Dog distemper, E. Zschokke (*Schweiz. Arch. Tierh., 42 (1900), No. 6, pp. 241–248, fig. 1*).—The author describes in detail the symptoms of this disease. It is stated that the form which was studied by the author was not what is ordinarily known as dog distemper, but it is correctly called gastritis hæmorrhagica. Numerous remedies were tried in the treatment of the disease without striking results. It was found that the most that could be hoped for was an alleviation of the more pronounced symptoms by careful dieting and nursing.

A method of demonstrating the capsule in all species of bacteria, I. Boni (*Centbl. Bakt. u. Par., 1. Abt., 28 (1900), No. 20, pp. 705–707*).—This method consists in staining the bacteria in carbolfuchsin or other anilin stains, then drying and washing with water and a secondary staining with methylene blue. By this method the author was able to demonstrate the capsule in a considerable variety of bacteria, including the micro-organisms of anthrax and glanders.

The disappearance of the so-called bactericidal action of blood serum on account of the addition of nutritive substances, Finkh (*Centbl. Bakt. u. Par., 1. Abt., 28 (1900), No. 20, pp. 694, 695*).—The author experimented with the micro-organisms of anthrax, typhus, and cholera. Freshly drawn rabbit serum was used for this purpose, and it was found that by the addition of peptone sugar the serum was rendered entirely inactive toward the anthrax bacillus.

The antibacterial action of the serums of animals treated with arsenic and creosote, E. Wiener (*Compt. Rend. Soc. Biol. Paris, 52 (1900), No. 39, pp. 1073–1075*).—The author conducted experiments on rabbits and dogs. These animals received injections of arsenic and creosote and their serums were later examined with reference to their action toward the micro-organisms of typhus and cholera. It was found that a preliminary treatment with arsenic or creosote considerably increased the action of protective substances which normally exist in the organism.

The theory of disinfection, H. Marx (*Centbl. Bakt. u. Par., 1. Abt., 28 (1900), No. 20, pp. 691–693*).—The author had previously demonstrated that the virulence of pathogenic bacteria disappeared with the disappearance of the Babes-Ernst bodies. Experiments were conducted for the purpose of determining whether these bodies were immediately affected by various disinfectants. It was found that corrosive sublimate and carbolic acid produced the complete disappearance of the Babes-Ernst bodies and that these structures were also destroyed by subjection to the temperature of boiling water. Experiments in disinfecting the hands indicate that the bacteria were not always completely destroyed but that the Babes-Ernst bodies were partially or completely annihilated.

The conditions of disinfecting by means of formalin fumes, C. Spengler (*Centbl. Bakt. u. Par., 1. Abt., 28 (1900), No. 20, pp. 704, 705*).—In experiments

with this substance the author found that the disinfecting power of formalin was considerably diminished in rooms filled with an unusually moist atmosphere. The most effective action of formalin in the destruction of tubercle bacillus was obtained when from 0.5 to 1 per cent of formic acid was added.

Experiments with Itrol and Actol, FRANZ (*Monatsh. Prakt. Thierh., 12 (1901), No. 2-3, pp. 104-107*).—The author obtained good results from the use of Itrol in cases of fistula, dermatitis, and long-standing wounds. It was found that Actol could be used in intravenous injections in cases where the colloidal silver preparation had been used with good results.

AGRICULTURAL ENGINEERING.

Water measurements, B. C. BUFFUM (*Wyoming Sta. Rpt. 1900, pp. 16*).—The measurements of the duty of water in irrigation given in this article are the same as those reported in Bulletin 81 of this Office, (E. S. R., 12, p. 295), with the addition of observations during 1899 on the amount of water necessary to produce a maximum crop, and the results of tests of two subirrigation systems at the station. The results of the experiments on the amount of water necessary to produce a maximum crop were inconclusive, since the largest amount of water applied was apparently insufficient to produce this result. "Sod land required more water than was necessary on older cultivated soil, and the largest amount of water applied was not excessive."

Two systems of subirrigation have been under observation at the station for a number of years. "One of these consists of an iron pipe 2 in. in diameter and 900 ft. long, used on the campus for irrigating trees. This pipe has given very satisfactory results, but it has not been practicable to measure the amount of water used in it. The other system consists of one-half acre on the experiment farm which is underlaid with porous tile. Lines of 4 in. tile are placed 18 in. deep and at distances of 20 ft. apart. These lines of pipe join 6 in. mains extending around the plat, which serve as feed and drain pipes." The results obtained in subirrigating wheat in 1899 are reported. The results of these experiments and of the general experience of the station with subirrigation "do not indicate that extraordinary crops are produced by this method of applying water, or that it is economical from the standpoint of the amount of water required to produce a crop. More water was used on the subirrigated land last season than on any other plat on the farm except one small field of alfalfa."

Experiments in road surfacing, C. H. PETTEE (*New Hampshire Sta. Bul. 77, pp. 147-160, figs. 2*).—In continuation of previous work (E. S. R., 9, p. 797) the author made comparative tests during 2 years of various surfacing materials, including gravel of different kinds, screened and unscreened, clay, sand, point rock, and stones 2 to 6 in. through, applied during the spring of 1898. The difference between

macadam, gravel, and earth roads is briefly explained, and the more important results of the experiments and observations reported are summed up as follows:

"(1) Country towns should do more surfacing, using the best materials available.

"(2) Sand should be removed from the gravel employed, and all gravel should be as uniform as possible.

"(3) Labor-saving machinery should be utilized to reduce expense.

"(4) Combinations of natural materials should be tried when the conditions are favorable."

Cultivation and irrigation in the western district (New South Wales), C. H. Gorman (*Agr. Gaz. New South Wales, 11 (1900), No. 8, pp. 632–634*).

Irrigation of oranges in Syria, M. Ringelmann (*Jour. Agr. Prat., 1901, I, No. 3, pp. 91–93, figs. 5*).—The use of various kinds of pumps for raising the underground water is discussed.

Treatise on the law of irrigation, covering all the States and Territories, with an appendix of statutory law, J. R. Long (*St. Paul: Keefe-Davidson Law Book Co., 1901, pp. 526*).

Ingenious water wheels, W. Fawcett (*Sci. Amer., 84 (1901), No. 7, p. 104, figs. 5*).—Descriptions are given of a number of devices for lifting water by means of water wheels and windmills in Nebraska.

Daily river stages at river gage stations on the principal rivers of the United States (*U. S. Dept. Agr., Weather Bureau Doc. 227, pp. 83*).—This is Part VI of a series of reports on river gage readings begun by the Signal Service in 1858 and continued by the Weather Bureau. It covers the years 1896, 1897, 1898 and 1899.

"River stations are maintained by the Weather Bureau for the purpose of making forecasts of river stages in the interest of navigation, and of issuing flood warnings in cases of dangerous rises. Daily gage readings are made at stations located on the various watersheds, and are collected by telegraph at 32 centers. . . .

"The tabulated gage readings are preceded by a statement which includes the locations of stations, descriptions of gages and bench marks, heights of danger lines, low-water, and flood marks, and other data, for the various river stations whose gage readings are included in the tables. The gage readings are arranged by river systems, and are preceded by two indexes—one alphabetical, with respect to the stations, and the second following the arrangement of the text."

The hydrography of Allegany County, F. H. Newell (*Maryland Geological Survey, Allegany County. Baltimore: Johns Hopkins Press, 1900, pp. 233–251, pls. 5, fig. 1*).—The hydrographic features of the county are briefly described and the results of gagings of the Potomac River at Cumberland during 1895, 1896, and 1897 are reported. Estimates of the monthly discharge of the river at that point are given, with discussions of the pollution of the Potomac and its tributaries, and the utilization of the water for municipal supplies and manufacturing purposes.

On the influence of plant cover on the flow of streams, E. Wollny (*Meteor. Ztschr. [Vienna], 17 (1900), No. 2, pp. 491–504*).

Second Biennial Report of the State Engineer to the Governor of Utah, 1899-1900, R. C. Gemmell (*pp. 100, pls. 7, map 1*).—This report contains descriptions of plans of State irrigation works, a record of stream measurements, an account of irrigation investigations made in cooperation with this Office,[1] a brief discussion of the State irrigation laws, the provisions of a proposed law relating to irrigation and water rights, and a table showing the discharge over Cippoletti trapezoidal weirs of different dimensions.

Trials of agricultural machinery at Ultuna: Automatic drinking devices, G. Timberg (*Landtmannen, 11 (1900), No. 34, pp. 549–550*).

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[1] U. S. Dept. Agr., Office of Experiment Stations Bul. 86, p. 197 (E. S. R., 12, p. 895).

Trials of agricultural machinery at Alnarp: Harrows and cultivators, A. Sjöström (*Landtmannen, 11 (1900), Nos. 22, pp. 345–351; 24, pp. 383–386*).

Agricultural implements at the Paris International Exhibition, 1900, F. S. Courtney (*Jour. Roy. Agr. Soc. England, 3. ser., 11 (1900), pt. 4, pp. 653–673, figs. 3*).

Borsig electric plow (*Sci. Amer. Sup., 51 (1901), No. 1309, p. 20988*).

Road making materials of Pennsylvania, M. C. Ihlseng (*Pennsylvania Dept. Agr. Bul. 69, pp. 104, pls. 13, figs. 5, map 1*).—This bulletin considers in detail the location, distribution, and comparative merits of the materials available for road making in Pennsylvania, and contains suggestions for the construction, maintenance, and repair of road surfaces.

Culverts, drainage, and road construction, W. R. Goit (*Kansas State Bd. Agr. Rpt. 1899–1900, pp. 648–656, figs. 10*).—This is a popular discussion of the importance of good roads and a brief explanation of various methods of road drainage, construction, and maintenance.

The Laramie cement plaster industry, E. E. Slosson and R. B. Moudy (*Wyoming Agr. Coll. Rpt. 1900, pp. 18, pl. 1*).—This article gives a brief description of the Laramie gypsite deposit, discusses the chemistry of cement plaster, and reports observations on the manufacture of cement plaster at Laramie, and tests of the effect of sand on the crushing strength of plaster, as well as of the effect of various retarders and accelerators on the time of setting.

STATISTICS—MISCELLANEOUS.

Eleventh Annual Report of Arizona Station, 1900 (*Arizona Sta. Rpt. 1900, pp. 138–186*).—This contains a report of the director on the work, staff, and publications of the station, including notes on additions to the experiment station farm, the date-palm orchard, range improvement, and on the needs of the station; a financial statement for the fiscal year ended June 30, 1900, and reports of the heads of departments, parts of which are noted elsewhere.

Twelfth Annual Report of Connecticut Storrs Station, 1899 (*Connecticut Storrs Sta. Rpt. 1899, pp. 223*).—A financial statement for the fiscal year ended June 30, 1899, a report of the director reviewing the work of the station during the year, and miscellaneous articles noted elsewhere.

Report of Florida Station, 1899 and 1900 (*Florida Sta. Rpt. 1899 and 1900, pp. 76*).—The report of the director deals with changes in the governing board and the station staff, the different lines of station work, publications of the station, and additions to station equipment. Financial statements are given for the fiscal years ended June 30, 1899 and 1900. Departmental reports, parts of which are noted elsewhere, are included.

Annual Report of Minnesota Station, 1900 (*Minnesota Sta. Rpt. 1900, pp. XXVI+746*).—The report proper contains the organization list of the station, a financial statement for the fiscal year ended June 30, 1900, and a general review by the director of the work of the different departments and of the experiment farms at Crookston, Grand Rapids, and Coteau. Reprints of Bulletins 65–68 of the station on the following subjects are included: Soil investigations (E. S. R., 11, p. 1018), beetles injurious to fruit-producing plants (E. S. R., 12, p. 166), investigation in milk production, feeding dairy cows (E. S. R., 12, pp. 479, 484), and subexperiment farms (E. S. R., 12, p. 627). A meteorological record (noted elsewhere) is appended.

Annual Report of South Dakota Station, 1899 (*South Dakota Sta. Rpt. 1899, pp. 6–8*).—Brief abstracts of Bulletins 61–64 of the station and a financial statement for the fiscal year ended June 30, 1899.

Annual Report of South Dakota Station, 1900 (*South Dakota Sta. Rpt. 1900, pp. 20–34*).—A general account of the work of the station during the year is

given in the reports of the director, agriculturist, horticulturist, chemist, entomologist and botanist, and the zoologist and veterinarian. A financial statement for the fiscal year ended June 30, 1900, is included.

Annual Report of Virginia Station, 1900 (*Virginia Sta. Rpt. 1900, pp. 14*).—This includes the organization list of the station, a report of the director containing mainly a summary of the bulletins issued during the year, a financial statement for the fiscal year ended June 30, 1900, and brief departmental reports.

Thirteenth Annual Report of West Virginia Station, 1900 (*West Virginia Sta. Rpt. 1900, pp. 24*).—A financial statement is given for the fiscal year ended June 30, 1900. The report of the director reviews at some length the different lines of station work, and summarizes briefly some of the results of investigations previously reported. A table is given showing the quantity and value of commercial fertilizers sold in the State during the last 5 years. Brief statements are made on the results of experiments on the effect of pressure in the preservation of perishable food stuffs and on methods of preserving eggs.

Tenth Annual Report of Wyoming Station, 1900 (*Wyoming Sta. Rpt. 1900, pp. 457*).—This includes notes on the origin and purpose of the station, brief abstracts of the bulletins issued during the year, plans of station work for 1900–1901, reports of the director and heads of departments, a financial statement for the fiscal year ended June 30, 1900, several articles abstracted elsewhere, and reprints of Bulletins 41–45 of the station on the following subjects: Some experiments with subsoiling (E. S. R., 11, p. 1026), some native forage plants for alkali soils (E. S. R., 12, p. 138), alfalfa as a hay crop (E. S. R., 12, p. 430), alfalfa as a fertilizer (E. S. R., 12, p. 427), and preliminary report on the artesian basins of Wyoming (see p. 1019).

Crop Reporter (*U. S. Dept. Agr., Division of Statistics Crop Reporter, Vol. 2, Nos. 7, pp. 8; 8, pp. 4; 9, pp. 8*).—In addition to statistical data on the crops of the United States in 1900, these numbers contain articles and notes on miscellaneous subjects, including the following: Cereal crops of France, sugar and rice crops of India, principal crops of Austria, the cotton-seed industry, the cotton crop of 1899–1900, the corn crop of the world, Russian cereal crops, the United States Department of Agriculture, Peruvian sugar statistics, apples in the United Kingdom, the jute crop of Bengal in 1900, the Hungarian estimate of the world's grain crops, wheat crop of Argentina, and principal crops of Germany in 1899–1900.

Trade of Denmark, F. H. HITCHCOCK (*U. S. Dept. Agr., Section of Foreign Markets Bul. 9, pp. 88, map 1*).—This is a detailed statistical review of the trade of Denmark for a number of years. The imports during the calendar year 1898 were valued at \$123,874,758, and the exports at \$87,464,660. About 90 per cent of the Danish commerce was carried on with the United Kingdom, Germany, Sweden, the United States, and Russia. The most important agricultural imports are Indian corn, butter, oil cake and oil-cake meal, coffee, and wheat. Butter is the most important article of export.

Maryland Geological Survey, Allegany County (*Baltimore: Johns Hopkins Press, 1900, pp. 323, pls. 30, figs. 15*).—This report contains, in addition to a brief introduction dealing with the physical features of Allegany County, articles on physiography, by C. Abbe, jr.; geology, by C. C. O'Harra; mineral resources, by W. B. Clark, C. C. O'Harra, R. B. Rowe, and H. Ries; soils, by C. W. Dorsey (see p. 1023); climate, by O. L. Fassig (see p. 1017); hydrography, by F. H. Newell (see p. 1097); magnetic declination, by L. A. Bauer; forests, by G. B. Sudworth; and flora and fauna, by C. Hart Merriam and E. A. Preble.

NOTES.

ARIZONA UNIVERSITY.—The last legislature gave the university $25,000 for a library building, and $30,000 for two years for maintenance.

CONNECTICUT STATE STATION.—W. C. Sturgis, botanist of the station, has been given six months' leave of absence.

COLORADO STATION.—George H. Glover, B. S., D. V. M., has been made professor of veterinary science. The president and secretary of the governing board and the president of the college have been reelected, the latter for a period of two years.

IDAHO STATION.—The governing board of the station, under a new law passed at the recent legislature, has been reduced to five members, and is at present comprised of the following members: President, John B. Goode, Cœur d'Alene; vice-president, Mrs. Mary E. Ridenbaugh, Boise; secretary, George C. Parkinson, Preston; J. W. Jones, Blackfoot; and Henry E. Wallace, Caldwell. Their terms of office, under the law, range from two to six years.

ILLINOIS UNIVERSITY AND STATION.—The Illinois general assembly has appropriated $46,000 per annum for the next two years for the extension of the work of the station. The bill specifies the following lines of work: Experiments with corn, $10,000; soil investigations, $10,000; investigations in horticulture, $10,000; experiments in stock feeding, $8,000; dairy experiments, $5,000; sugar-beet experiments, $3,000. Any revenues which may accrue from these experiments revert to their respective funds. The college of agriculture receives $10,000 for furnishing the new agricultural building, $8,000 per annum for the purchase of live stock, and $6,000 for increase in instructional work. The station chemical laboratory in the new agricultural building is now furnished and occupied. It consists of a general laboratory, a special laboratory, 1 workroom, 1 storeroom for chemicals and apparatus, and another for samples for analysis, and an office. The new building was dedicated May 21, 1901. The principal addresses were made by Prof. Thomas F. Hunt, of Ohio, an alumnus of the college, and by Hon. Joseph G. Cannon, of Illinois, and brief addresses were made by Dr. Thomas J. Burrill, Prof. E. Davenport, and representatives of various farmers' and breeders' organizations of the State. There was a large attendance from out of town, representing nearly every agricultural organization and interest in the State, among others the Illinois Farmers' Institute, the Dairymen's Association, the State Horticultural Society, the Live Stock Breeders' Association, the Corn Breeders' Association, the Corn Growers' Association, and the Sugar Beet Association. The occasion was one of general good feeling and of satisfaction at the increased facilities for instruction, and also at the largely increased funds both for instruction and investigation. The most flattering assurances were given of liberal support in the future.

NEBRASKA STATION.—A. L. Haecker has been appointed dairy husbandman on the staff of the station, having charge of the newly created department of dairy husbandry.

PENNSYLVANIA STATION.—B. P. Lundy has resigned his position as fellow in dairy husbandry to accept a position in Haddonfield, N. J. A repetition of the feeding experiment with steers made last winter, comparing the effects of feeding in pens and stalls, with and without a supply of water, has just been completed. As a supplement to this experiment, an attempt is being made to compare the value of the manure actually produced by these several methods of handling. The observations on forage plants which have been made in previous years are to be continued and

extended during the present season with special reference to their value in a system for soiling for dairy cattle.

South Carolina Station.—At a recent meeting the board ordered the entire separation of college and station cattle, and decided to purchase first-class specimens of four breeds for experimental work. The veterinarian has in progress an experiment in rendering young cattle immune to Texas fever by inoculation. The experiments which the station has been making in the preparation of sweet potatoes for commerce and for army rations have proved very promising and will be continued on a larger scale.

Texas College and Station.—At the recent session of the legislature an appropriation of $3,000 was provided for additions to the equipment of the agricultural building, erected in 1900, which money is immediately available and will be used for class-room appliances, apparatus, and special forms of scientific equipment for the college and station, the general equipment of the building having been already supplied. A bill appropriating $30,000 for additional State stations passed the senate and was favorably reported by the house committee on agriculture, but its final consideration was postponed until the special session of the legislature to be convened next August, as were also the appropriations for the purchase of improved breeds of live stock ($10,000) and for erecting a veterinary-chemical laboratory ($31,000). The Beeville Station was provided for at the former rate, $2,500 per annum, with the privilege of using the proceeds from sales of crops and products.

Virginia Station.—John Spencer, D. V. S., of Canada, has been appointed assistant veterinarian of the station, in place of H. Bannister, resigned.

Wisconsin University and Station.—The legislature of Wisconsin, recently adjourned, appropriated $150,000 for a central building for the college of agriculture. Plans for the proposed building were presented to the legislature for their consideration. There will be the general offices of the college of agriculture, several museum rooms, a library and reading room, a general audience room seating 700, and laboratories for the departments of agricultural chemistry and agricultural bacteriology. It is proposed to locate the new building on Observatory Hill near the dairy and horticultural buildings. Like the other distinctly agricultural college buildings it will be heated from a central heating plant now completed. As the building is to be provided for from funds raised by taxation, it will probably be two years before it is completed.

Miscellaneous.—The following notice has been received from the Federation of Agricultural Unions in Italy (*Federazione Italiana dei Consorzi Agrari*) regarding a prize offered by the federation for a method for the determination of the fineness of flowers of sulphur and of mixtures of sulphur and copper sulphate such as are used in fungicides and insecticides: "Although of late years there has been considerable progress in the methods of preparation of the different sorts of sulphur used for combating diseases of plants, and the demand, in consequence, has greatly increased, the methods actually employed for estimating the degree of fineness of these preparations are now antiquated and leave much to be desired, especially as regards the mixtures of sulphur and copper sulphate. The Federation of the Agricultural Unions of Italy, together with the Agricultural Unions of Padua and Florence, considering the necessity of encouraging special studies on this subject, and having obtained contributions from many other agricultural unions, has now decided to open an international prize competition for the sum of 1,000 francs in gold, to be awarded to the person who discovers and makes public the best method for obtaining exact and constant results in the determination of the fineness of the flowers of sulphur and of mixtures of sulphur and copper sulphate. Competitors must send in their papers in a sealed envelope to the head office of the federation (*Ufficio direttivo della Federazione Italiana dei Consorzi agrari, Piacenza-Italy*) before March 1, 1902. The papers will be examined by a special commission to be named by the Reale Accademia dei Lincei-Rome whose decision will be without appeal. Piacenza, 1st March, 1901. E. Cavalieri, president; G. Raineri, director."

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U. S. DEPARTMENT OF AGRICULTURE

OFFICE OF EXPERIMENT STATIONS

A. C. TRUE, DIRECTOR

Vol. XII No. 6

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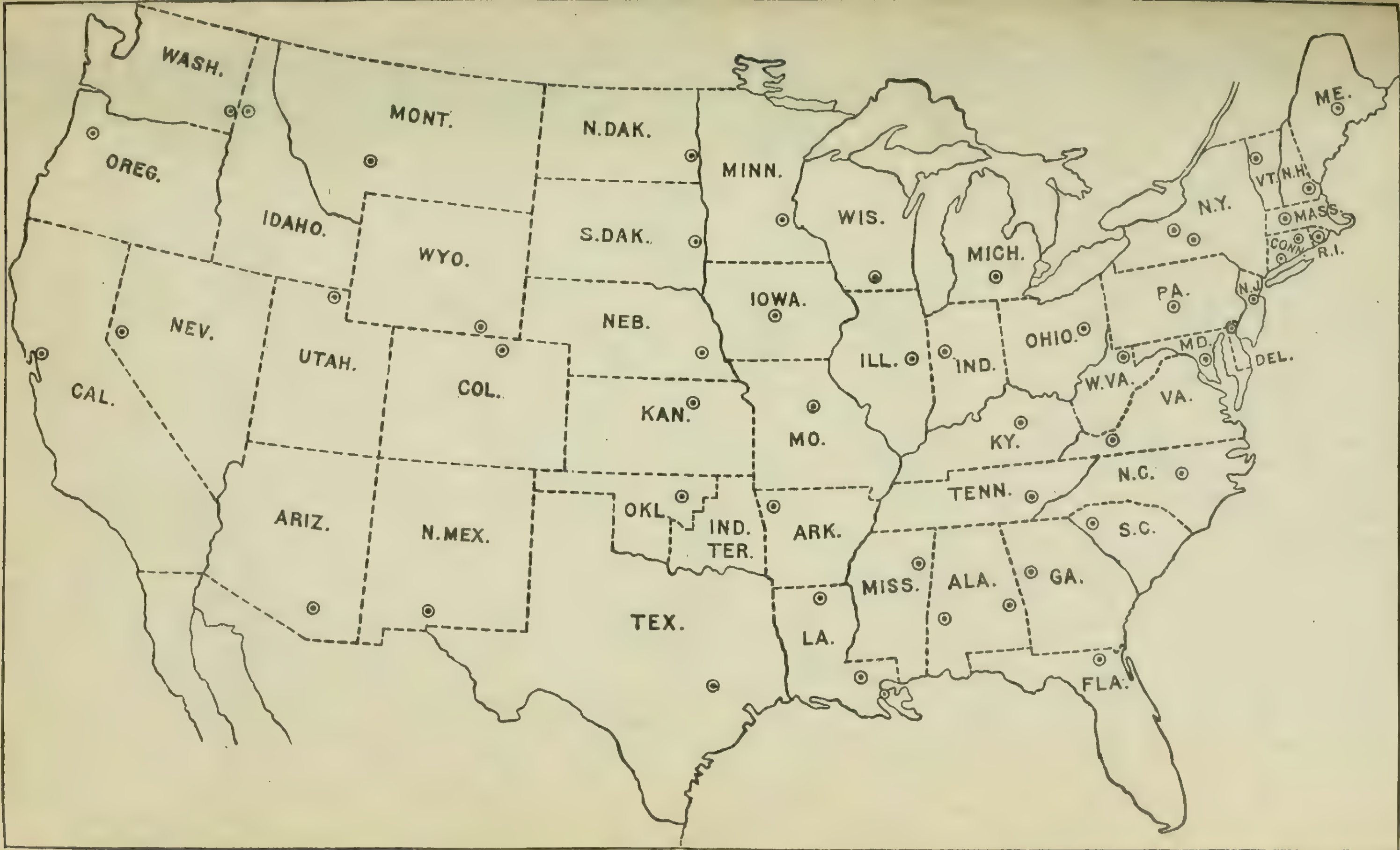
PUBLICATIONS OF THE OFFICE OF EXPERIMENT STATIONS.

Experiment Station Record, Vols. I-XI, with indexes; Vol. XII, Nos. 1-5.

Bulletins.—No. 1, Organization and History of the Stations; No. 2, Digest of Annual Reports of the Stations for 1888, in two parts; No. 3, Report of Meeting of Horticulturists, 1889; No. 4, List of Station Horticulturists; No. 6, List of Station Botanists; No. 8, Lectures on Investigations at Rothamsted Experimental Station; No. 9, The Fermentations of Milk; No. 10, Meteorological Work for Agricultural Institutions; No. 11, A Compilation of Analyses of American Feeding Stuffs; No. 14, Proceedings of Convention of National League for Good Roads, 1893; No. 15, Handbook of Experiment Station Work; No. 17, Suggestions for the Establishment of Food Laboratories; No. 18, Assimilation of Free Atmospheric Nitrogen by White and Black Mustard; No. 21, Methods and Results of Investigations on the Chemistry and Economy of Food; No. 22, Agricultural Investigations at Rothamsted, England; No. 25, Dairy Bacteriology; No. 26, Agricultural Experiment Stations: Their Objects and Work; No. 28, The Chemical Composition of American Food Materials; No. 29, Dietary Studies at the University of Tennessee in 1895; No. 31, Dietary Studies at the University of Missouri in 1895; No. 32, Dietary Studies at Purdue University in 1895; No. 33, The Cotton Plant; No. 34, The Carbohydrates of Wheat, Maize, Flour, and Bread; No. 35, Food and Nutrition Investigations in New Jersey in 1895 and 1896; No. 36, Notes on Irrigation in Connecticut and New Jersey; No. 37, Dietary Studies at the Maine State College in 1895; No. 38, Dietary Studies of the Negro in Alabama, 1895 and 1896; No. 40, Dietary Studies in New Mexico in 1895; No. 42, Cotton Culture in Egypt; No. 43, Losses in Boiling Vegetables, and the Composition and Digestibility of Potatoes and Eggs; No. 44, Investigations on the Metabolism of Nitrogen and Carbon in the Human Organism; No. 45, A Digest of Metabolism Experiments; No. 46, Dietary Studies in New York City in 1895 and 1896; Nos. 48, 62, and 82, Reports to Congress on Agriculture in Alaska; No. 52, Nutrition Investigations in Pittsburg, Pa., 1894-1896; No. 53, Nutrition Investigations at the University of Tennessee in 1896 and 1897; No. 54, Nutrition Investigations in New Mexico in 1897; No. 55, Dietary Studies in Chicago in 1895 and 1896; No. 56, History and Present Status of Instruction in Cooking in the Public Schools of New York City; No. 57, Varieties of Corn; No. 58, Water Rights on the Missouri River and its Tributaries; No. 60, Abstract of Laws for Acquiring Titles to Water from the Missouri River and its Tributaries, with the Legal Forms in Use; No. 63, Description of a New Respiration Calorimeter and Experiments on the Conservation of Energy in the Human Body; No. 66, The Physiological Effect of Creatin and Creatinin and their Value as Nutrients; No. 67, Studies on Bread and Bread Making; No. 68, A Description of Some Chinese Vegetable Food Materials and their Nutritive and Economic Value; No. 69, Experiments on the Metabolism of Matter and Energy in the Human Body; No. 70, Water-Right Problems of Bear River; No. 71, Dietary Studies of Negroes in Eastern Virginia in 1897 and 1898; No. 72, Farmers' Reading Courses; No. 73, Irrigation in the Rocky Mountain States; No. 75, Dietary Studies of University Boat Crews; No. 77, The Digestibility of American Feeding Stuffs; No. 79, Farmers' Institutes: History and Status in the United States and Canada; No. 80, The Agricultural Experiment Stations in the United States; No. 81, The Use of Water in Irrigation in Wyoming and its Relation to the Ownership and Distribution of the Natural Supply; No. 84, Nutrition Investigations at the California Agricultural Experiment Station, 1896-1898; No. 85, A Report of Investigations on the Digestibility and Nutritive Value of Bread; No. 86, The Use of Water in Irrigation; No. 87, Irrigation in New Jersey; No. 89, Experiments on the Effect of Muscular Wo k upon the Digestibility of Food and the Metabolism of Nitrogen, Conducted at the University of Tennessee, 1897-1899. Nos. 5, 12, 13, 19, 23, 27, 39, 47, 59, and 74, Organization Lists of Stations and Colleges, 1890, 1892, 1893, 1894, 1895, 1896, 1897, 1898, 1899, and 1900; Nos. 7, 16, 20, 24, 30, 41, 49, 65, and 76, Proceedings of Association of Colleges and Stations, 1891, 1892, 1893, 1894, 1895, 1896, 1897, 1898, and 1899; Nos. 50, 61, and 83, Reports on the Work and Expenditures of the Agricultural Experiment Stations, 1897, 1898, and 1899; Nos. 51, 64, and 78, Statistics of the Colleges and Stations, 1897, 1898, and 1899.

Farmers' Bulletins.—No. 1, The What and Why of Agricultural Experiment Stations; No. 2, The Work of the Agricultural Experiment Stations; No. 9, Milk Fermentations, and their Relation to Dairying; No. 11, The Rape Plant; No. 14, Fertilizers for Cotton; No. 16, Leguminous Plants for Green Manuring and for Feeding; No. 18, Forage Plants for the South; No. 21, Barnyard Manure; No. 22, The Feeding of Farm Animals; No. 23, Foods: Nutritive Value and Cost; No. 25, Peanuts: Culture and Uses; No. 26, Sweet Potatoes: Culture and Uses; No. 29, Souring of Milk and Other Changes in Milk Products; No. 32, Silos and Silage; No. 34, Meats: Composition and Cooking; No. 35, Potato Culture; No. 36, Cotton Seed and its Products; No. 37, Kafir Corn: Characteristics, Culture, and Uses; No. 39, Onion Culture; No. 41, Fowls: Care and Feeding; No. 44, Commercial Fertilizers: Composition and Use; No. 46, Irrigation in Humid Climates; No. 48, The Manuring of Cotton; No. 49, Sheep Feeding; No. 74, Milk as Food; No. 76, Tomato Growing; No. 77, The Liming of Soils; No. 81, Corn Culture in the South; No. 85, Fish as Food; No. 93, Sugar as Food; Nos. 56, 65, 69, 73, 78, 79, 84, 87, 92, 97, 103, 105, 107, 114, 119, and 122, Experiment Station Work, I-XVI; No. 109, Farmers' Reading Courses; No. 112, Bread and the Principles of Bread Making; No. 116, Irrigation in Fruit Growing; No. 121, Beans, Peas, and other Legumes as Food.



THE AGRICULTURAL EXPERIMENT STATIONS OF THE UNITED STATES.